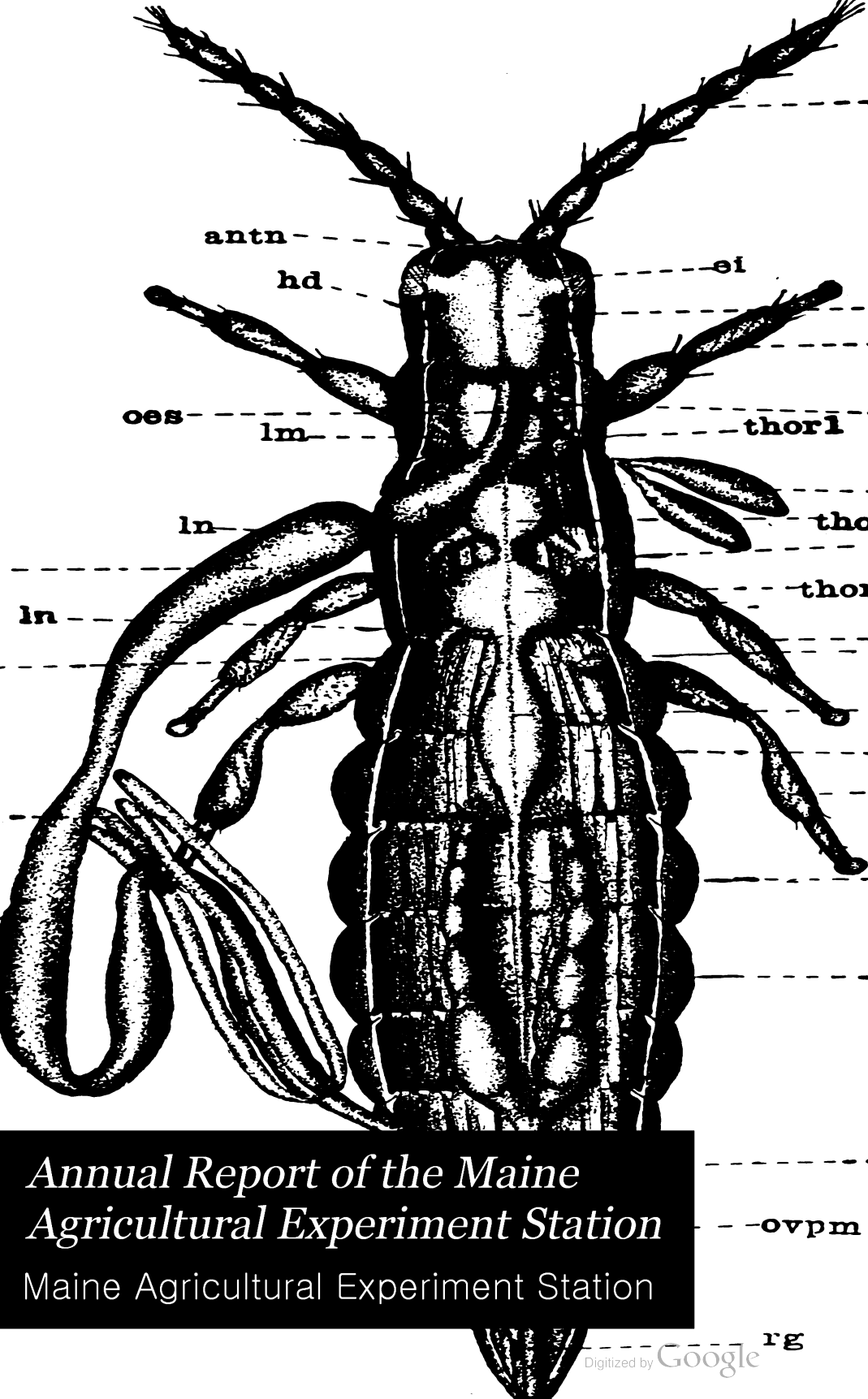


# *Annual Report of the Maine Agricultural Experiment Station*

Maine Agricultural Experiment Station

EIGHTEENTH ANNUAL REPORT

OF THE

# Maine Agricultural Experiment Station

ORONO, MAINE,

1902.

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AUGUSTA
KENNEBEC JOURNAL PRINT
1903.

The Station

The Bulletins of this Station will be sent free to any address in Maine. All requests should be sent to

Agricultural Experiment Station,
Orono, Maine.

## STATE OF MAINE.

*Geo. E. Fellows, Ph. D., President of the University of Maine:*

SIR:—I transmit herewith the Eighteenth Annual Report of the Maine Agricultural Experiment Station for the year ending December 31, 1902.

CHARLES D. WOODS,
*Director.*

ORONO, ME., December 31, 1902.

# MAINE

# AGRICULTURAL EXPERIMENT STATION,

# ORONO, MAINE.

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* Resigned February, 1902.
† Resigned June, 1902.
‡ Resigned May, 1902.
§ Appointed July, 1902.

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# ANNOUNCEMENTS.

## THE AIM OF THE STATION.

Every citizen of Maine concerned in agriculture has the right to apply to the Station for any assistance that comes within its province. It is the wish of the Trustees and Station Council that the Station be as widely useful as its resources will permit.

In addition to its work of investigation, the Station is prepared to make chemical analyses of fertilizers, feeding stuffs, dairy products and other agricultural materials; to test seeds and creamery glass-ware; to identify grasses, weeds, injurious fungi and insects, etc.; and to give information on agricultural matters of interest and advantage to the citizens of the State.

All work proper to the Experiment Station and of public benefit will be done without charge. Work for the private use of individuals is charged for at the actual cost to the Station. The Station offers to do this work only as a matter of accommodation. Under no condition will the Station undertake analyses, the results of which cannot be published, if they prove of general interest.

## INSPECTIONS.

The execution of the laws regulating the sale of commercial fertilizers, concentrated commercial feeding stuffs, and agricultural seeds, and the inspection of chemical glassware used by creameries is entrusted to the Director of the Station. The Station officers take pains to obtain for analysis samples of all brands of fertilizers and feeding stuffs coming under the law, but the organized co-operation of farmers is essential for the full and timely protection of their interests. Granges, Farmers' Clubs and other organizations can render efficient aid by reporting any attempt at evasion of the laws and by sending, early in the sea-

son, samples taken from stock in the market and drawn in accordance with the Station directions for sampling. In case there should be a number of samples of the same brand sent in, the Station reserves the right to analyze only in part.

### STATION PUBLICATIONS.

The Station publishes several bulletins each year, covering in detail its expenses, operations, investigations and results. The bulletins are mailed free to all citizens who request them.

### CORRESPONDENCE.

As far as practicable, letters are answered the day they are received. Letters sent to individual officers are liable to remain unanswered, in case the officer addressed is absent. All communications should, therefore, be addressed to the

Agricultural Experiment Station,
Orono, Maine.

The post office, railroad station, freight, express and telegraph address is Orono, Maine. Visitors to the Station can take the electric cars at Bangor and Old Town.

The telephone call is "Orono 5."

Directions, forms and labels for taking samples, of fertilizers, feeding stuffs and seeds for analysis can be had on application.

Parcels sent by express should be prepaid, and postage should be enclosed in private letters demanding a reply.

CHAS. D. WOODS, *Director.*

# FEEDING CHICKENS FOR GROWTH.

By G. M. Gowell.

## COOPS vs. HOUSE AND YARD.

This test is a continuation of work reported in Bulletin No. 64 where small coops, holding four chickens each, were compared with small pens containing 20 birds of the same age and size. The purpose was to learn if close confinement in small numbers, gives better results than where larger numbers are kept together without close crowding.

The English and French chicken fatteners, who make a specialty of the business, fattening many thousands each year, use small coops holding four or five birds each and claim advantages for the method. This plan of fattening has been adopted by the Canadian government and illustrated by it at various places, for the purpose of encouraging the use of better methods by the people. The work has been favorably noticed by the poultry journals of this country and under this encouragement the method seemed likely of adoption by our poultrymen and farmers. The coops we used are similar in size and form to theirs and our food was prepared and fed in the same way as theirs, but it was of different composition, as theirs was made largely from finely ground oats and tallow, while we used corn meal, wheat middlings and ground beef scrap, with small quantities of finely ground oats in the earlier tests. That our gains with the birds in small coops were as great as those made by the foreigners is shown by the reports which they have published.

The coops that we used had each a floor space 16 by 23 inches. They were constructed of laths with close end partition of boards. The floors were of laths placed three-fourths of an inch apart, and one inch from the walls, so that they might be kept clean by the moving about of the birds. The coops were made, two

together, without cutting the laths. The laths ran lengthwise of the coops on bottom, top and back, but on the front they were placed upright, and two inches apart, so that the chickens could feed through between them readily. V-shaped troughs with three inch sides were placed in front of and about two inches above the level of the floor of the coops.

### FEEDING TEST NO. 4.

On July 25th 20 Plymouth Rock cockerels that were 95 days old, and even in size and thrift were put in five of the coops and fed twice daily for 28 days on porridge made from a mixture of 100 pounds of corn meal, 100 pounds of wheat middlings, and 40 pounds of animal meal mixed up with cold water. They were fed all they would eat twice each day. On the same day that these birds were cooped, 68 of their mates, of the same age and quality, were put in a chicken house 9 by 11 feet in size, with an attached yard 15 by 20 feet. There were no green plants in this yard. These birds were fed in the same way, and on the same material as their mates in the small coops. The results are shown in the tables that follow:

CHICKENS IN SMALL COOPS.

FEED MIXED WITH WATER.

| Coop. | Group 1. | Live Weights during Test. | | | | | Increase. | |
|---|---|---|---|---|---|---|---|---|
| | | July 25. | August 1. | August 8. | August 15. | August 22. | Lot. | Each. |
| | | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 1 | Four Plymouth Rock cockerels ..... | 12.6 | 14.4 | 15.8 | 17.7 | 19.1 | 6.5 | 1.62 |
| 2 | Four Plymouth Rock cockerels..... | 13.8 | 15.4 | 16.4 | 16.9 | 18.5 | 4.7 | 1.17 |
| 3 | Four Plymouth Rock cockerels..... | 13.7 | 15.1 | 16.2 | 17.4 | 18.4 | 4.7 | 1.17 |
| 4 | Four Plymouth Rock cockerels..... | 14.0 | 16.0 | 17.3 | 17.8 | 18.6 | 4.6 | 1.15 |
| 5 | Four Plymouth Rock cockerels..... | 14.8 | 17.1 | 18.5 | 20.0 | 21.2 | 6.4 | 1.60 |
| | Total weights.. .... ..... | 68.9 | 78.0 | 84.2 | 89.8 | 95.8 | 26.9 | 1.34 |
| | Increase each week..... ..... ... | .... | 9.1 | 6.2 | 5.6 | 6.0 | | |

Pounds of dry meal mixture used, 240.
Pounds of mixture required to produce a pound of gain, 8.92.
Age of chickens at commencement of test, 95 days.

SIXTY-EIGHT CHICKENS (MATES TO THOSE IN GROUPS 1 AND 2) CONFINED IN SMALL HOUSE AND YARD, AND FED 28 DAYS ON SAME FOOD AS THOSE IN GROUP 1.

| Live Weights. | | Increase in Weights. | |
|---|---|---|---|
| July 25. | August 22. | Lot of 68. | Each. |
| 199.3 pounds..... | 296.8 pounds .. ..... | 97.5 pounds..... | 1.43 pounds. |

Pounds of dry meal mixture used, 513.
Pounds of mixture required to produce a pound of gain, 5.26.

## FEEDING TEST NO. 5.

The conditions under which this test was made were like those in No. 4 except in the composition of the food. The chickens were from the same hatch and of like quality with the others; both trials were made at the same time and the food was prepared and fed in the same manner in both cases. In this test the food was from a mixture of 100 pounds of corn meal, 100 pounds of wheat middlings and 33 pounds of meat meal, mixed as used with cold skim-milk. Two pounds of the skim-milk was used with one pound of the mixed meal.

The following tables show the work as it progressed and the results:

CHICKENS IN SMALL COOPS.

FEED MIXED WITH MILK.

| Coop. | Group 2. | Live Weights during Test. | | | | | Increase. | |
|---|---|---|---|---|---|---|---|---|
| | | July 25. | August 1. | August 8. | August 15. | August 22. | Lot. | Each. |
| | | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 6 | Four Plymouth Rock cockerels ..... | 13.3 | 14.2 | 16.2 | 18.0 | 19.2 | 5.9 | 1.47 |
| 7 | Four Plymouth Rock cockerels ..... | 14.8 | 16.6 | 18.1 | 19.5 | 21.4 | 6.6 | 1.65 |
| 8 | Four Plymouth Rock cockerels ..... | 12.4 | 14.1 | 16.0 | 17.4 | 18.8 | 6.4 | 1.60 |
| 9 | Four Plymouth Rock cockerels ..... | 15.0 | 17.6 | 19.8 | 22.0 | 23.4 | 8.4 | 2.10 |
| 10 | Four Plymouth Rock cockerels ..... | 12.1 | 14.4 | 15.8 | 17.6 | 18.5 | 6.4 | 1.60 |
| | Total weights ..... .... ..... | 67.6 | 76.9 | 85.9 | 94.5 | 101.3 | | |
| | Increase in weights ..... ..... | ..... | 9.3 | 9.0 | 8.6 | 6.8 | 33.7 | 1.68 |

Pounds of dry meal mixture used, 231.
Pounds of skim-milk used, 465.
Pounds of dry mixture required to produce a pound of gain, 6.85.
Age of chickens at commencement of test, 95 days.

SIXTY-EIGHT CHICKENS (MATES TO THOSE IN GROUPS 1 AND 2) CONFINED IN SMALL HOUSE AND YARD, AND FED 28 DAYS, ON SAME FOOD AS THOSE IN GROUP 2.

| Live Weights. | | Increase in Weights. | |
|---|---|---|---|
| July 25. | August 22. | Lot. | Each. |
| 202.9 pounds.... ... | 319.4 pounds.... .... | 116.5 pounds.... ... | 1.713 pounds. |

Pounds of dry meal mixture used, 469.5.
Pounds of skim milk used, 934.
Pounds of dry mixture required to produce a pound of gain, 4.03.

## FEEDING TEST NO. 6.

The purposes and conditions were the same as with No. 4 excepting that the chickens were 160 days old. This test was continued 21 days. The results are given in the following tables:

CHICKENS IN SMALL COOPS.

FEED MIXED WITH WATER.

| Coop. | Group. | Live Weights during Test. | | | | Increase. | |
|---|---|---|---|---|---|---|---|
| | | October 11. | October 18. | October 25. | November 1. | Lot. | Each. |
| | | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 1 | Four Plymouth Rock cockerels ..... | 17.4 | 18.1 | 20.4 | 22.4 | 5.0 | 1.25 |
| 2 | Four Plymouth Rock cockerels ..... | 19.7 | 20.6 | 20.8 | 21.4 | 1.7 | .42 |
| 3 | Four Plymouth Rock cockerels. .... | 19.7 | 20.6 | 23.2 | 23.3 | 3.6 | .90 |
| 4 | Four Plymouth Rock cockerels ..... | 20.0 | 21.3 | 21.8 | 22.8 | 2.8 | .70 |
| 5 | Four Plymouth Rock cockerels ..... | 18.8 | 19.8 | 20.6 | 21.3 | 2.5 | .62 |
| | Total weights..... ..... | 95.6 | 100.4 | 106.8 | 111.2 | 15.6 | .78 |
| | Increase each week . ..... | ..... | 4.8 | 6.4 | 4.4 | | |

Pounds of dry meal mixture used, 152.
Pounds of dry mixture required to produce a pound of gain, 9 74.
Length of feeding period, 21 days.
Age of chicken at commencement of test, 160 days.

TWENTY-FIVE CHICKENS (MATES TO THOSE IN TABLE NEXT PRECEDING THIS) CONFINED IN SMALL HOUSE AND FED 21 DAYS ON SAME FOOD MIXTURE AS THOSE IN TABLE REFERRED TO.

| Live Weights. | | Increase in Weights. | |
|---|---|---|---|
| October 11. | November 1. | Lot. | Each. |
| 121.1 pounds..... | 132.3 pounds..... | 11.2 pounds ... .... | .45 pounds. |

Pounds dry meal mixture used, 189.
Pounds of dry mixture required to produce a pound of gain, 16.87.

## FEEDING TEST NO. 7.

The conditions were the same as with No. 6 except that the porridge was made by use of skim-milk instead of water. The results are given in the tables which follow:

CHICKENS IN SMALL COOPS.

FEED MIXED WITH MILK.

| Coop. | Group. | Live Weights during Test. | | | | Increase. | |
|---|---|---|---|---|---|---|---|
| | | October 11. | October 18. | October 25. | November 1. | Lot. | Each. |
| | | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 6 | Four Plymouth Rock cockerels..... | 18.5 | 20.5 | 21.0 | 22.0 | 3.5 | .87 |
| 7 | Four Plymouth Rock cockerels..... | 20.2 | 21.4 | 22.6 | 24.4 | 4.2 | 1.05 |
| 8 | Four Plymouth Rock cockerels..... | 20.8 | 22.4 | 22.8 | 23.5 | 2.7 | .67 |
| 9 | Four Plymouth Rock cockerels..... | 18.7 | 20.4 | 21.0 | 22.4 | 3.7 | .92 |
| 10 | Four Plymouth Rock cockerels..... | 22.0 | 23.3 | 25.2 | 25.4 | 3.4 | .85 |
| | Total weights ..... | 100.2 | 108.0 | 112.6 | 117.7 | 17.5 | .875 |
| | Increase each week. ..... | ..... | 7.8 | 4.6 | 5.1 | | |

Pounds of dry meal mixture used, 144.
Pounds of skim milk used, 290.
Pounds of dry mixture required to produce a pound of gain, 8.22.
Length of feeding period, 21 days.
Age of chickens at commencement of test, 160 days.

TWENTY-FIVE CHICKENS (MATES TO THOSE IN THE TABLE ABOVE) CONFINED IN SMALL HOUSE AND FED 21 DAYS ON THE SAME FOOD MIXTURE AND MILK AS THOSE IN THE TABLE REFERRED TO.

| Live Weights. | | Increase in Weights. | |
|---|---|---|---|
| October 11. | November 1. | Lot. | Each. |
| 121.7 pounds..... | 144.9 pounds..... | 23.2 pounds..... | .928 pounds. |

Pounds dry meal mixture used, 177.
Pounds skim milk used, 360.
Pounds mixture required to produce a pound of gain, 7.63.

## CONCLUSIONS.

*Small coops vs. houses and yards*—Including the test reported in Bulletin No. 64, this Station has made six group trials of close confinement against partial liberty, in fattening chickens. These have comprised the use of 35 separate coops and 6 houses. Three hundred and twenty-one chickens of different ages have been fed in these 41 lots, in periods of 21, 28, or 35 days each, and the occupants of all coops have had weekly weighings.

In 11 of the coops containing 4 birds each, the gains have been greater than in the houses and yards containing from 20 to 68 birds, with which they were matched. In the 24 other coops, the gains were less than in the houses and yards with which they were similarly matched. In five of the six groups, the gains have been greater in the houses and yards, and in one of the six groups the gain has been greater in the coops.

These results show that close cooping is not necessary in order to secure the greatest gains in chicken fattening, and that the chicken made greater gains when given a little liberty than when kept in close confinement.

The labor involved in caring for birds in small numbers in coops, is greater than in caring for an equal number in a house and yard. The results are so pronounced that we regard them as conclusive.

*Relation of age to fattening*—The tables show plainly that with poultry the periods of cheap and rapid gains in weight come early in life. The greatest gains were made in one of the tests reported in Bulletin No. 64, where in a feeding period of 35 days, 40 chickens confined in coops gained an average of 2.23 pounds each, and 20 others of like age and condition fed in comparison

in a house and yard gained 2.47 pounds each. The rations which these birds received was partly made up of ground oats, and the feeding period was 35 days in length, instead of 21 or 28 days, as in tests No.'s 4, 5, 6 and 7. These conditions probably account for the greater gains which were made.

In tests No.'s 4 and 5 the birds were 95 days old at the beginning of the feeding period, which continued 28 days. The average gain was 1.54 pounds each.

In tests No.'s 6 and 7 the birds were 160 days old at the beginning of the test, which lasted 21 days instead of 28 as in No.'s 4 and 5. They gained .75 pounds each or about one-half as much as the gain made by the chickens that were 95 days old. The matter of age was not designed as a feature of the tests when planning them, but the results are so marked that they should not be overlooked.

*Skim-milk as chicken food*—In tests 4 and 6 water was used in mixing the meal for feeding, and in 5 and 7 milk was used.

The composition of the mixture in which water was used was 100 pounds of corn meal, 100 pounds of wheat middlings and 40 pounds of ground beef scrap. The mixture in which milk was used was the same as the water mixture, except that it contained 33 pounds of ground beef scrap instead of 40 as in the water mixture. This difference was made so that the two rations should be equal in digestible protein. Two pounds of milk were used to each pound of the meal mixture.

The following table shows the results collectively. Compare tests No. 4 with No. 5, and No. 6 with No. 7 for results in separate coops.

| Chickens 95 days old. | Feed mixed with water. | Feed mixed with milk. |
|---|---|---|
| | Lbs. | Lbs |
| In coops, gained in 28 days each | 1.34 | 1.68 |
| In houses, gained in 28 days each | 1.43 | 1.71 |
| Chickens 160 days old. | | |
| In coops, gained in 28 days each | .78 | .87 |
| In house, gained in 28 days each | .45 | .93 |

*The use of meat meal in chicken fattening.*—Late in the season 40 chickens that were 161 days old, and averaged in weight a little over five pounds each, were divided into 10 lots. Each lot of four birds was put into a small fattening coop and fed for 28 days. Those in coops 1 to 5, constituting group 1, were fed from a mixture of 100 pounds of corn meal, 100 pounds of wheat middlings and 50 pounds of meat meal. Twice daily as needed for use, porridge was made from this meal mixture with cold water. Those in coops 6 to 10, constituting group 2, were fed on porridge made from equal quantities of corn meal and wheat middlings, without meat meal. This porridge was also made with cold water.

The average increase in weight of each of the 20 birds fed without meat meal was .72 pounds, and the average increase of those fed with meat meal was .92 pounds. Where no meat meal was fed, 14.96 pounds of dry meal was required to make a pound of gain. Where meat meal was fed, 12.07 pounds of dry meal produced a similar gain.

This indicates that where one fifth of the food used was meat meal, a pound of gain in the live birds was made by the use of about one fifth less weight of food than where no meat meal was used. The mixture containing the meat meal cost 1.15 cents per pound, while the mixture without meat meal cost 1 cent per pound. Where meat meal was fed, a pound of live weight of chicken was made at a cost of 13.88 cents. Where no meat meal was used a pound of gain cost 14.96 cents.

These tests were made with birds that were advanced in age and growth, and the gains were slow and expensive. In other feeding tests that we have made with chickens that were from 100 to 130 days old, the gains have been much greater and the costs per pound as small as 5 to 8 cents per pound, when the meal used was reckoned at the same price per pound as in this test. The data of the test is shown in the tables following:

CHICKENS FED WITH MEAT MEAL IN RATION.

| Coop. | Group 1. | Live Weights during Test. | | | | | Increase. | |
|---|---|---|---|---|---|---|---|---|
| | | October 5. | October 12. | October 19. | October 26. | November 2. | Lot. | Each. |
| | | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 1 | Four White Wyandottes..... | 20.2 | 22.3 | 23.3 | 23.6 | 24.6 | 4.4 | 1.10 |
| 2 | Four White Wyandottes..... | 20.1 | 21.9 | 22.1 | 22.4 | 23.4 | 3.3 | .82 |
| 3 | Four Plymouth Rocks..... | 20.4 | 22.8 | 23.2 | 23.6 | 24.8 | 4.4 | 1.10 |
| 4 | Four Plymouth Rocks..... | 20.7 | 22.4 | 23.4 | 23.8 | 24.2 | 3.5 | .87 |
| 5 | Four White Wyandottes..... | 21.5 | 22.1 | 23.1 | 23.3 | 24.2 | 2.7 | .67 |
| | Total weights ..... ... | 102.9 | 111.5 | 115.1 | 116.7 | 121.2 | | |
| | Increase in weights..... | ..... | 8.6 | 3.6 | 1.6 | 4.5 | 18.3 | .915 |

Pounds of dry grain mixture used in the test, 221.
Pounds of mixture required to produce a pound of gain, 12.07.
Age of birds at beginning of test, 161 days.
Average weight of birds at beginning of test, 5.14 pounds.

CHICKENS FED WITHOUT MEAT FOOD IN RATION.

| Coop. | Group 2. | Live Weights during Test. | | | | | Increase. | |
|---|---|---|---|---|---|---|---|---|
| | | October 5. | October 12. | October 19. | October 26. | November 2. | Lot. | Each. |
| | | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 6 | Four White Wyandottes..... | 21.4 | 22.0 | 22.4 | 22.5 | 22.8 | 1.4 | .35 |
| 7 | Four Plymouth Rocks..... | 21.4 | 22.1 | 22.4 | 22.4 | 24.2 | 2.8 | .70 |
| 8 | Four Plymouth Rocks..... | 20.6 | 22.9 | 23.6 | 24.4 | 25.6 | 5.0 | 1.25 |
| 9 | Four White Wyandottes..... | 20.7 | 22.2 | 22.6 | 22.8 | 23.0 | 2.3 | .57 |
| 10 | Four White Wyandottes. ..... | 20.3 | 21.6 | 21.8 | 22.8 | 23.1 | 2.8 | .70 |
| | Total weights ..... .. | 104.4 | 110.8 | 112.8 | 113.9 | 118.7 | | |
| | Increase in weights..... | ..... | 6.4 | 2.0 | 1.1 | 4.8 | 14.3 | .715 |

Pounds of dry grain mixture used in the test, 214.
Pounds of mixture required to produce a pound of gain, 14.96.
Age of birds at beginning of test, 161 days.
Average weight of birds at beginning of test, 5.22 pounds.

# EXPERIMENTS IN INCUBATION.

G. M. GOWELL.

## TREATMENT OF EGGS BEFORE INCUBATION.

### *Close Cases vs. Light and Air.*

Some of the influences which may affect the strength of the germs of eggs that are kept for some time before being incubated, were studied by keeping part of them shut up in the dark, in ordinary egg cases for ten days, while another lot from the same hens was kept spread out in open pans, in the light, on a stand beside the darkened case. This gave both lots practically the same temperature of 62° F. They were turned daily. It was unfortunate that the eggs were running low in fertility when all of the tests which are reported in this Bulletin were being made, but the hens had been laying very heavily for a long time, and that probably accounts for their low fertility. Two pens of hens were selected and the eggs of each individual were divided evenly into two lots by alternating them in the order in which they were laid. This was readily done as trap nests are used with all our birds and all the hens are banded and numbered. By taking each hen's eggs as laid and dividing them by placing alternate eggs in the same lots, a fair division was secured by which it was hoped to avoid the difficulties which might arise from the physical changes which are liable to take place in laying hens.

The eggs were laid between May 25th and June 2nd. After 160 were obtained, they were kept for the next ten days, until June 12th and then put together into the same incubator, each egg being marked with the number of the hen that laid it, the date and its class.

The following tables show some of the details of the work and the results of the test.

DATES ON WHICH EGGS WERE LAID AND RESULTS OF INCUBATION.

| Number of hens. | May 25. | May 26. | May 27. | May 28. | May 29. | May 30. | May 31. | June 1. | June 2. |
|---|---|---|---|---|---|---|---|---|---|
| 641 | L. Inf. | ..... | D. Inf. | L. Inf. | ..... | ..... | ..... | L. Inf | D. Inf |
| 642 | D. 12 | L. 12 | D. 12 | L. C'k. | D. 12 | L. 12. | D. 12. | L. C'k | D. 12. |
| 643 | ..... | D. C'k. | L. 12 | D. 12 | L. C'k. | D. C'k | L. C'k | D. C'k | ..... |
| 644 | L. 12 | ..... | ..... | D. 12 | ..... | ..... | ..... | ..... | ..... |
| 645 | L. 12 | ..... | ..... | D. 12 | L. 12 | D. C'k | ..... | L. 12 | ..... |
| 646 | D. C'k | ..... | ..... | L. 20 | D. 20 | L. 12. | D. C'k | L. 15. | D. 12. |
| 647 | L. 12 | D. 12 | L. C'k. | D. 12 | L. 12 | ..... | ..... | D. 12. | L. 12. |
| 648 | ..... | ..... | ..... | ..... | ..... | ..... | D. C'k | ..... | L. C'k |
| 649 | D. C'k. | L. 12 | D. C'k. | L. 12 | D. 12 | ..... | L. 12. | D. 12. | L. C'k |
| 650 | ..... | D. Inf. | L. 12 | D. 12 | ..... | L. 20. | ..... | D. 12. | L. 20. |
| 652 | L. 12 | ..... | ..... | D. C'k. | ..... | ..... | ..... | ..... | ..... |
| 653 | ..... | ..... | ..... | ..... | ..... | D. 12. | L. 20. | D. 12. | ..... |
| 654 | ..... | ..... | D. C'k. | ..... | L. C'k. | D. 12. | L. C'k | D. C'k | L. 12. |
| 657 | D. C'k. | ..... | ..... | L. 12 | D. C'k. | L. 20. | D. 12. | L. 12. | ..... |
| 658 | ..... | ..... | ..... | D. C'k. | L. C'k. | ..... | D. C'k | L. 12. | D. C'k |
| 659 | L. 12 | D. 12 | L. 12. | D. C'k. | L. 12 | ..... | D. 12. | L. C'k | ..... |
| 661 | D. Inf. | L. 12 | D. 12. | L. 20 | D. 12. | ..... | L. 12. | D. 12. | ..... |
| 662 | L. 12 | ..... | D. 12. | L. 12 | D. C'k. | ..... | ..... | ..... | L. 12. |
| 664 | D. 12 | ..... | L. C'k. | D. C'k. | L. 15 | ..... | D. 12. | L. 20. | D. C'k |
| 665 | ..... | ..... | D. 12 | L. 12 | D. 12. | L. 12. | ..... | D. C'k | L. C'k |
| 668 | ..... | ..... | ..... | ..... | L. C'k. | D. 14. | L. 14. | D. 20. | ..... |
| 669 | L. C'k. | D. 12 | L. 12. | D. C'k. | L. 12 | D. C'k | L. 12. | D. C'k | L. 20. |
| 670 | ..... | ..... | D. C'k. | L. C'k. | ..... | D. C'k | ..... | L. C'k | D. C'k |
| 671 | ..... | ..... | ..... | ..... | ..... | ..... | D. 20. | ..... | L. 12. |
| 672 | L. 12 | D. 12 | L. 12 | ..... | D. 12. | L. 12. | D. C'k | L. C'k | D. 20. |
| 674 | ..... | ..... | ..... | ..... | D. C'k. | L. C'k | D. 12. | L 20 | D. 20. |
| 676 | D. Inf. | L. Inf. | D. Inf. | ..... | L. Inf. | ..... | D. Inf | ..... | ..... |
| 678 | L. 12 | ..... | D. 12 | ..... | ..... | ..... | ..... | ..... | ..... |
| 680 | D. Inf. | L. Inf. | D. Inf | L. Inf. | D. Inf. | L. Inf | ..... | D. Inf | L. Inf |

D means that the eggs in the spaces in which it occurs were kept in the dark and the letter L means those that were in the light.

C'k means that a chick was hatched from the egg.

Inf. means that the eggs were completely infertile.

The 12 signifies that the germs stopped developing by or before the 12th day after incubation commenced, and the figures 20 indicate that development ceased between the 12th and 20th days.

SUMMARY OF RESULTS.

| Method of storing eggs. | Number of eggs incubated. | Number of chicks hatched. | Number of eggs infertile. | Number of eggs in which development stopped by the 12th day of incubation. | Number of eggs in which development stopped between 12th and 20th days of incubation. |
|---|---|---|---|---|---|
| In closed cases | 81 | 30 | 11 | 36 | 5 |
| In open air | 79 | 19 | 9 | 41 | 9 |

## *Effects of Temperature upon Eggs while being held for Incubation.*

From May 25th to June 2nd all of the eggs laid by 24 hens were saved and held 10 days, until June 12th before being incubated. The eggs from each hen were divided into two lots by selecting each alternate one as laid. One of the lots was placed in a room with a temperature of 70° F. and the other lot was put in another room where the temperature was 50° F. There was about the same amount of moisture in each room, and both were equally light. The eggs were in open boxes and were turned each day. The temperatures were steadily maintained through the 10 days, at the end of which time the eggs were all put together into the same incubator where they were subject to like conditions.

The tables below show the behavior of the eggs from each individual hen, under the same, and varied temperature, as well as the results of the test.

DATES ON WHICH EGGS WERE LAID AND RESULTS OF INCUBATION.

| Number of hens. | May 25. | May 26. | May 27. | May 28. | May 29. | May 30. | May 31. | June 1. | June 2. |
|---|---|---|---|---|---|---|---|---|---|
| 601... | 70°. Inf.. | 50°. Inf. | 70°. Inf. | 50°. Inf. | ..... | ..... | 70°. 12. | 50°. 20. | 70°. 12. |
| 604... | 50°. 12... | ..... | 70°. C'k. | 50°. C'k. | ..... | 70°. 20. | ..... | 50°. 20. | ..... |
| 606... | 70°. 12... | ... ..... | 50°. C'k. | ... ..... | 70°. C'k. | . ..... | 50°. 12. | ..... | ..... |
| 607... | 50.. 20... | 70°. 20... | 50°. C'k. | 70°. C'k. | 50°. 12... | ..... .. | ..... | ..... | ..... |
| 608... | 70°. 12... | ... . .. | ..... | 50°. 20. . | 70°. 12... | 50°. 12. | 70°. 20. | 50°. C'k | 70°. 12. |
| 609... | ..... . . | ..... ... | ..... ... | ..... .. | ... .... | 70°. C'k | .... ... | 50°. C'k | 70°. C'k |
| 612... | 70°. 12... | 50°. 20... | 70°. C'k. | ..... | 50°. C'k. | 70°. C'k | 50°. C'k | 70°. 12. | 50°. C'k |
| 616... | 50°. 20... | .... . .. | 70°. C'k. | ..... | 50°. 12... | .... ... | ..... | 70°. 20. | 50°. 20. |
| 617... | ... .... | 70°. C'k. | 50°. C'k. | 70°. 12... | 50°. 20... | ..... | 70°. 20. | 50°. C'k | 70°. 20. |
| 619... | ..... . | 50°. 12... | 70°. 20... | 50°. 12... | 70°. 12... | 50°. 20. | 70°. 20. | 50°. C'k | 70°. 20. |
| 620... | ..... ... | 70°. C'k. | ... ..... | ..... | 50°. 20... | ..... | 70°. C'k | 50°. C'k | 70°. 20. |
| 621... | ..... | 50°. C'k. | 70°. 20... | 50°. 20... | .. ..... | 70°. 20 | 50°. C'k | 70°. C'k | ..... |
| 622.. | ..... | .... ..... | ..... | ..... .... | 70°. C'k. | 50°. C'k | 70°. C'k | 50°. 20. | 70°. 12. |
| 623... | ..... | ... . .... | .. .... | 50°. Inf | ..... | 70°. Inf | 50°. Inf. | ..... | 70°. Inf. |
| 624... | 50°. 20... | 70°. 20... | 50°. 12... | 70°. 12... | 50°. 12... | ..... | 70°. C'k | ... ... | ..... |
| 625... | ..... .... | 50°. 20.. | 70°. 20... | 50°. 20... | 70°. C'k. | ..... | ..... | 50°. 20. | 70°. 20. |
| 626... | 70°. C'k. | 50°. 20... | ..... | 70°. C'k. | 50°. C'k. | ... .... | .... ... | ..... | ..... . |
| 628... | ..... | 70°. 12... | ..... | 50°. 12... | 70°. 12... | ..... | 50°. 20. | ..... | 70°. 20. |
| 630... | ... ..... | ..... | ..... | ... ..... | ..... ... | ... ... | ..... ... | 70°. C'k | 50°. 12. |
| 631... | 50°. 12... | .... .... | ... . .... | 70°. 20... | 50°. 20... | ..... | 70°. 12. | 50°. 12. | 70°. 12. |
| 632... | 70°. 12... | .. . .... | 50°. 12... | 70°. C'k. | ..... | 50°. 12. | .... ... | ..... | ..... |
| 635... | 50°. 20... | 70°. 20... | 50°. 20... | 70°. 20... | ..... ... | 50°. 20. | ..... | 70°. 12. | 50°. C'k |
| 636... | ..... ... | 50°. 12... | .. ..... | 70°. 12... | ..... | ..... | .. .... | .... ... | .... ... |
| 640... | 70°. C'k. | 50°. C'k. | .. ... ... | 70°. C'k. | 50°. C'k. | 70°. C'k | 50°. 12. | ..... | 70°. 12. |

The figures 50° mark the eggs that were kept at fifty degrees of temperature and the figures 70° indicate the eggs that were held at seventy degrees.

The other instructions are explained at foot of table on page 19.

SUMMARY OF RESULTS.

| Temperature at which eggs were kept. | Number of eggs incubated. | Number of chicks hatched. | Number of eggs infertile. | Number of eggs in which development stopped by 12th day of incubation. | Number of eggs in which development stopped between 12th and 20th day of incubation. |
|---|---|---|---|---|---|
| 70° F ..... | 66 | 23 | 4 | 20 | 19 |
| 50° F ..... | 62 | 18 | 4 | 18 | 22 |

*Resting Eggs after transit before Incubating them.*

Poultry breeders and shippers of eggs for incubating purposes frequently instruct purchasers to rest their eggs for 24 hours after their receipt before putting them into incubators, claiming better results from eggs so treated than where incubating commenced immediately upon their arrival.

To watch the results of such treatment, all of the eggs laid by 26 White Wyandotte hens, from May 25th to June 2nd, were divided into two lots by alternating them as laid by each hen. Part of the eggs laid each day were put in one lot and part in the other. This and the alternating of the eggs was done so as to secure as nearly as possible equal conditions in each lot. Both of these lots of eggs were put in an ordinary shipping egg case and sent from Orono by express, over the Maine Central and the Bangor and Aroostook Railroads to Houlton and return, and after remaining in the express office at Orono over night, the journey to Houlton and return was repeated. The eggs were on the road and waiting at the railroad stations about 36 hours, and the distance covered was 514 miles. Upon their last arrival at Orono, after transit they were immediately taken to the incubator room, and one lot put into an incubator with a temperature of 103°, while the other lot was allowed to rest 24 hours, at the end of which time they were put into the incubator together with the first lot. The day before hatching was due to commence, one lot of the eggs was removed to another machine which had the same temperature and moisture as the first one. This was done so as to avoid the difficulties which might arise from the hatching of eggs in the same machine with other eggs that were not due. The details and results are shown in the following tables:

DATES ON WHICH EGGS WERE LAID.

| Number of hens. | May 25. | May 26. | May 27. | May 28. | May 29. | May 30. | May 31. | June 1. | June 2. |
|---|---|---|---|---|---|---|---|---|---|
| 741 | R. 12 | N. C'k | | R. 12 | N. Inf. | R. C'k | N. C'k | | |
| 742 | | R. Inf. | N. Inf. | R. Inf. | N. Inf. | | R. 12 | N. C'k | R. 20 |
| 743 | | N. Inf. | R. 20 | | N. C'k. | | R. 20 | | |
| 744 | N. Inf | R. Inf. | N. C'k. | R. C'k. | N. C'k. | | | | |
| 745 | R. 12 | N C'k. | | R. 20 | | N. 12 | R. 20 | N. 20 | |
| 747 | R. Inf. | N. Inf. | | R. 12 | | | N. C'k | | |
| 748 | N. C'k. | R. C'k. | N. 12 | R. C'k. | | | | | |
| 749 | R. 12 | N. Inf. | R. Inf. | N. Inf. | R. Inf. | N. Inf | R. Inf | N. Inf | |
| 753 | N. Inf. | R. C'k. | N. 20 | R. C'k. | | | R. 12 | N. C'k | R. C'k |
| 754 | | | | R. 12 | | N. 12 | | | R. C'k |
| 756 | | R. Inf. | | N. 12 | R. Inf. | | N. 12 | | |
| 760 | | | R. 12 | N. C'k. | | R. 20 | | N. 12 | |
| 762 | N. C'k. | | R. 20 | N. C'k. | R. 20 | | N. 20 | R. 12 | N. C'k |
| 763 | | N. 12 | R. 12 | | N. C'k. | R. C'k | | N. 12 | R. 12 |
| 764 | | | | R. 20 | N. C'k. | | R. 12 | N. Inf | R. 12 |
| 765 | R. 12 | N. C'k. | | R. Inf. | N. Inf. | R. Inf | | N. 12 | R. 12 |
| 766 | | R. Inf. | N. Inf. | | | | | | |
| 768 | | | | | N. 12 | | R. C'k | | N. 12 |
| 770 | N. 20 | | R. 20 | N. 20 | | | | | |
| 772 | R. Inf. | N. Inf. | R. C'k. | N. 12 | | | | | |
| 774 | N. C'k. | | R. C'k. | | | | | | |
| 776 | R. Inf. | | | N. C'k. | | R. 12 | N. 12 | | R. Inf |
| 777 | N. 12 | | R. C'k. | | N. C'k. | R. C'k | | N. 12 | R. C'k |
| 778 | R. 12 | | N. C'k. | R. 20 | N. Inf. | | R. Inf | N. 12 | R. 20 |
| 779 | | | | N. Inf. | R. 12 | | N. 12 | | R. Inf |
| 780 | N. Inf. | | | R. 20 | | N. 20 | R. 12 | N. C'k | |

The letter R marks the eggs that rested and N indicates those that were not rested. The other marks in the table are explained on page 19.

SUMMARY OF RESULTS.

| Treatment of eggs. | Number of eggs incubated. | Number of chicks hatched. | Number of eggs infertile. | Number of eggs in which development stopped by 12th day of incubation. | Number of eggs in which development stopped between the 12th and 20th days of incubation. |
|---|---|---|---|---|---|
| Rested | 65 | 15 | 17 | 20 | 13 |
| Not rested | 63 | 22 | 18 | 17 | 20 |

## TIME REQUIRED TO ESTABLISH FERTILITY IN EGGS.

The following experiment was undertaken to determine how soon after mating eggs become sufficiently fertile to yield chicks. For this purpose there were selected 20 Barred Plymouth Rock hens one year old, that had been laying heavily during the five to seven months preceding, but had not been in the company of male birds since they were young chicks. Late on the evening of May 25 a cockerel 12 months old was placed in the pen with them and

kept there until the close of the test. The eggs laid each succeeding day until June 6th were incubated.

The eleven eggs laid May 26th were all removed after having been in the incubator eight days. Eight of them were clear and the three others showed very light traces of fertility. At the same time the eight eggs laid May 27th were examined and three of them showed clear, three were slightly cloudy and two had good strong centers and radiating lines. From these eggs two good strong chicks were hatched on the twentieth day of incubation. The best results were obtained from the eggs laid June 2nd, eight days after the introduction of the male bird. From the ten eggs laid that day, ten good chicks were hatched and two eggs were completely infertile.

This test shows that eggs become fertile very soon after mating commences. As it was after dark when the cockerel was put in the pen with the hens it is not at all probable that he mated with any hen until daylight the next morning, May 26th, yet the eggs laid by two of the hens May 27th, not more than 40 hours after mating, yielded vigorous chicks.

TABLE SHOWING THE NUMBER OF EGGS SECURED FROM THE HENS EACH DAY AFTER THE INTRODUCTION OF THE COCKEREL, THE NIGHT OF MAY 25, AND THE NUMBER OF CHICKS HATCHED FROM THEM.

| | Eggs laid. | Chicks hatched. |
|---|---|---|
| May 26 | 11 | 0 |
| May 27 | 8 | 2 |
| May 28 | 13 | 3 |
| May 29 | 10 | 1 |
| May 30 | 12 | 3 |
| May 31 | 10 | 3 |
| June 1 | 13 | |
| June 2 | 10 | 8 |
| June 3 | 9 | 4 |
| June 4 | 11 | 4 |
| June 5 | 11 | 6 |
| June 6 | 10 | 3 |

## CONTINUANCE OF FERTILITY OF HENS EGGS AFTER MATING CEASES.

To learn how long after the mating of hens and cockerels has been discontinued, the eggs remain sufficiently fertile to yield healthy chickens, 20 Barred Plymouth Rock hens were selected and the cockerel that had been mated with them since February 1st was removed on the evening of May 24th and was not returned again. The eggs laid on May 25th and on each succeeding day, to and including June 6th, were incubated and their fertility noted. Each day's eggs were kept in separate lots in the incubator so that at the completion of the period all eggs could be accounted for.

On the last day the eggs were saved—June 6th—the male bird had been removed from the pen containing the hens 13 days and the hens had had no opportunity to mate with other males, yet the eight eggs laid that day yielded three good chicks. The 27 eggs laid during the first three days after the removal of the male yielded ten chicks. The 30 eggs laid on the 11th, 12th and 13th days after the removal of the males yielded seven chicks.

TABLE SHOWING THE NUMBER OF EGGS SECURED FROM THE HENS EACH DAY AFTER THE REMOVAL OF THE COCKEREL THE NIGHT OF MAY 24 AND THE NUMBER OF CHICKS HATCHED FROM THEM.

| | Eggs laid. | Chicks hatched. |
|---|---|---|
| May 25 | 11 | 4 |
| May 26 | 5 | 2 |
| May 27 | 11 | 4 |
| May 28 | 10 | 4 |
| May 29 | 9 | 3 |
| May 30 | 12 | 4 |
| May 31 | 10 | 4 |
| June 1 | 11 | 3 |
| June 2 | 6 | 2 |
| June 3 | 10 | 2 |
| June 4 | 12 | 4 |
| June 5 | 10 | 0 |
| June 6 | 8 | 3 |

While the results show somewhat diminished fertility, it is evident that longer test periods are needed in which to determine the limits of its duration after mating ceases. This work is to be continued with other pens of hens. The preceding table shows the results from each days eggs.

FERTILITY OF EGGS OF DIFFERENT SHAPES.

To ascertain whether the shapes of eggs have any influence on their chick yielding capacities when incubated, 25 very long eggs, 25 short, ball shaped ones and 25 normal shaped ones were selected and incubated in the same machine with the following results:

| | Chicks hatched out. | Died in shell when well grown. | Germ died by the tenth day. | Infertile. |
|---|---|---|---|---|
| Twenty-five normal eggs | 8 | 3 | 5 | 9 |
| Twenty-five very long eggs | 9 | 2 | 2 | 12 |
| Twenty-five short, roundish eggs | 7 | 7 | 3 | 8 |

When undertaking this test it was the intention to carry each lot of chicks until their sex could be determined in order to learn whether the shape of the egg bears any relationship to the sex of the chick it may yield. With that aim all of the chicks were banded and recorded. A barn cat had other plans regarding them however, in the carrying out of which one night, the question of sex was not considered. Other tests bearing upon this subject will be made.

## BREEDING FOR EGG PRODUCTION.

G. M. GOWELL.

For several years past the Station has been breeding Barred Plymouth Rock and White Wyandotte hens with the hope of increasing the number and improving the size and color of the eggs.

In 1898 trap nests were devised and placed in all of the breeding pens, as described in the 14th annual report of the Station. This was done so that the producing capacities of hens could be known, and selections for breeding could be made upon merit alone.

It is known that the laws of inheritance and transmission are as true with birds as with cattle, sheep and horses and when we consider the wonderful advance in egg production that the hen has made since her domestication, there is ample reason for assuming that a higher average production than the present can be secured by breeding only to those birds that are themselves large producers. It has been found in our practice with the trap nest, that with the most careful selection we could make when estimating the capacities for egg yielding, by the types and forms of birds, that we were still including in our breeding pens hens that were small workers.

A study of the monthly record sheets which follow, not only show great differences in the capacities of hens but marked variations in the regularity of their work; some commencing early in November, and continuing laying heavily and regularly month after month, while others varied much, laying well one month and poorly or not at all the next. It is impossible to account for these vagaries as the birds in each breed were bred alike, and selected for their uniformity. All pens were of the same size and shape and contained the same number of birds. Their feeding and treatment were alike throughout. Many of the light layers gave evidence of much vitality, and in many instances there were no marked indications, in form or type, by which we were able to account for the small amount of work performed by them.

## EGG RECORDS FOR TWO YEARS OF HENS HATCHED DURING APRIL AND MAY 1898.

### BARRED PLYMOUTH ROCKS.

| Number of hens. | Year. | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | Yields Nov. 1st, 1898, to Nov. 1st, 1899, and Nov. 1st, 1899, to Nov. 1st, 1900. | Yields in first full year of laying. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6.. | 1st ... | 18 | 12 | 7 | 15 | 18 | 16 | 15 | 8 | 14 | 6 | 12 | 20 | 161 | 161 |
| | 2d . ... | 10 | 16 | 10 | 6 | 5 | 3 | .... | 1 | 1 | 4 | 5 | ..... | 61 | ..... |
| 10.. | 1st .... | 16 | 14 | 5 | 20 | 23 | 19 | 19 | 18 | 17 | 10 | 14 | ..... | 175 | 175 |
| | 2d ..... | .... | .... | 5 | 3 | * | ... | .... | .... | .... | ..... | .... | . ... | 8 | ..... |
| 26.. | 1st..... | 5 | 19 | 4 | 15 | 18 | 13 | 13 | 15 | 12 | 12 | 12 | 17 | 155 | 158 |
| | 2d ..... | 8 | 15 | .... | .... | 15 | 14 | 10 | 9 | 10 | 10 | 11 | 16 | 118 | ..... |
| 30.. | 1st..... | 7 | 7 | 18 | 16 | 19 | 19 | 19 | 20 | 22 | 8 | 8 | 2 | 165 | 165 |
| | 2d ..... | 1 | .... | 5 | 3 | 5 | 16 | 18 | 20 | 16 | 17 | 8 | 3 | 112 | .... ... |
| 31.. | 1st..... | 6 | 5 | 9 | 22 | 23 | 20 | 20 | 18 | 18 | 16 | 9 | 8 | 175 | 175 |
| | 2d ..... | ... | . .. | .... | 4 | 9 | 17 | 21 | 8 | 10 | 11 | 14 | . ... | 94 | ..... |
| 36.. | 1st..... | .... | 15 | 9 | 23 | 23 | 19 | 16 | 21 | 19 | 13 | 15 | 8 | 181 | 201 |
| | 2d ..... | 20 | 5 | 9 | 16 | 15 | 13 | 14 | 13 | 14 | 15 | 14 | 11 | 159 | ..... |
| 45 | 1st..... | ... | 17 | 22 | 19 | 22 | 17 | 15 | 14 | 13 | 11 | 7 | 9 | 142 | 166 |
| | 2d ..... | 13 | 1 | ... | 9 | 6 | ... | .... | 9 | 17 | 11 | 11 | 12 | 89 | ..... |
| 51.. | 1st..... | .... | 7 | 14 | 14 | 20 | 17 | 16 | 24 | 24 | 22 | 18 | 15 | 191 | 191 |
| | 2d ..... | ... | .. | ... | 4 | 9 | 17 | 21 | 8 | 10 | 11 | 14 | ..... | 94 | ..... |
| 74.. | 1st..... | .... | 5 | 18 | 18 | 21 | 14 | 18 | 16 | 15 | 15 | 7 | 18 | 165 | 182 |
| | 2d . ... | 17 | 15 | 16 | 8 | 13 | 14 | 15 | 11 | 11 | 14 | 17 | ..... | 151 | ..... |
| 76.. | 1st..... | .... | ... | 15 | 20 | 18 | 18 | 22 | 19 | 24 | 19 | 14 | ..... | 169 | 169 |
| | 2d ..... | .... | . .. | 4 | 7 | 3 | 18 | 6 | 1 | 1 | ..... | ..... | ..... | 40 | ..... |
| 80.. | 1st..... | ... | .... | 16 | 22 | 15 | 7 | 17 | 17 | 15 | 19 | 10 | 12 | 140 | 160 |
| | 2d ..... | 15 | 5 | 3 | 16 | 12 | 6 | 13 | 8 | 8 | 9 | 5 | 3 | 108 | ..... |
| 93.. | 1st..... | 19 | 11 | 19 | 8 | 10 | 18 | 18 | 16 | 14 | 11 | 11 | 5 | 160 | 160 |
| | 2d ..... | 11 | 5 | 19 | 10 | 13 | 18 | 15 | 13 | 12 | 8 | 12 | 9 | 145 | ..... |
| 101.. | 1st. ... | .. | . .. | 18 | 15 | 21 | 22 | 24 | 21 | 17 | 26 | 17 | 21 | 201 | 204 |
| | 2d ..... | 3 | .. . | 18 | 6 | 3 | .... | .... | .... | .... | ..... | .... | ..... | 30 | ..... |
| | 3d ..... | .... | 3 | 12 | 3 | 6 | 10 | 5 | 6 | .. . | 11 | 7 | ..... | 63 | ..... |
| 114.. | 1st..... | .... | .... | 15 | 22 | 20 | 14 | 12 | 14 | 12 | 9 | 9 | 9 | 136 | 149 |
| | 2d . ... | 13 | .... | ... | ... | 13 | 18 | 18 | 12 | 13 | 14 | 16 | 13 | 130 | ..... |
| 120.. | 1st..... | .... | .... | 17 | 20 | 17 | 13 | 15 | 18 | 24 | 20 | 22 | 18 | 184 | 188 |
| | 2d . ... | 4 | .... | 7 | 6 | .... | 19 | 19 | 13 | 18 | 13 | ..... | ..... | 99 | ..... |
| 126.. | 1st.. .. | .. | .... | 11 | 12 | 21 | 19 | 18 | 20 | 14 | 11 | 15 | 11 | 152 | 180 |
| | 2d ..... | 14 | 14 | 14 | 15 | 7 | 16 | 18 | 14 | 17 | 15 | 9 | 9 | 162 | ..... |
| 137.. | 1st. ... | .... | ... | 7 | 19 | 18 | 18 | 24 | 21 | 22 | 19 | 7 | ..... | 155 | 155 |
| | 2d ..... | .. | ... | 4 | 7 | 7 | 12 | 18 | 15 | 19 | 19 | 6 | 9 | 116 | ..... |
| 151.. | 1st..... | ... | .... | 9 | 20 | 16 | 8 | 13 | 19 | 18 | 12 | 15 | 5 | 135 | 155 |
| | 2d ..... | 13 | 5 | 11 | 16 | 15 | 12 | 18 | 14 | 10 | 19 | 19 | 9 | 161 | ..... |
| 159.. | 1st..... | ... | .... | 4 | 25 | 9 | 13 | 13 | 14 | 14 | 12 | 15 | 18 | 137 | 175 |
| | 2d .... | 20 | 18 | 14 | 10 | 11 | 15 | 17 | 13 | 13 | 13 | 12 | 12 | 168 | ..... |
| 205.. | 1st..... | .... | .... | .... | 21 | 23 | 12 | 21 | 22 | 19 | 19 | 15 | 13 | 165 | 191 |
| | 2d ..... | 14 | 1 | 11 | 14 | 15 | 18 | 20 | 15 | 15 | 14 | 14 | 14 | 165 | ..... |
| 208.. | 1st..... | .... | ... | 2 | 22 | 19 | 11 | 19 | 22 | 15 | 15 | 12 | 14 | 151 | 169 |
| | 2d ..... | 3 | .... | 20 | 7 | 12 | 12 | 16 | 9 | 3 | .... | ..... | ..... | 82 | ..... |
| 209.. | 1st..... | .... | .... | 2 | 20 | 20 | 18 | 18 | 13 | 17 | 17 | 12 | 17 | 154 | 180 |
| | 2d . ... | 10 | 10 | 18 | 15 | 12 | 16 | 13 | ... | ... | ..... | ..... | ..... | 94 | ..... |
| 228.. | 1st. .... | ... | .... | ... | 12 | 14 | 13 | 17 | 13 | 15 | 12 | 13 | 11 | 120 | 153 |
| | 2d ..... | 16 | 8 | 9 | 13 | 15 | 13 | 15 | 9 | 10 | 7 | .... | ..... | 115 | ..... |
| 246.. | 1st..... | .. | .... | .... | 14 | 21 | 17 | 12 | 21 | 17 | 22 | 18 | 1 | 143 | 143 |
| | 2d . ... | .... | ... | ... | ... | 5 | 11 | 3 | 6 | 14 | 6 | 1 | ..... | 46 | ..... |
| 281.. | 1st..... | .... | ... | ... | 12 | 20 | 15 | 12 | 16 | 13 | 17 | 12 | 12 | 129 | 167 |
| | 2d ..... | 11 | 18 | 9 | 8 | 7 | 9 | 11 | 8 | 12 | 12 | 10 | 10 | 125 | ..... |
| 286.. | 1st..... | ... | .... | .... | 14 | 23 | 15 | 18 | 24 | 25 | 23 | 26 | 23 | 191 | 206 |
| | 2d ..... | 1 | .... | 14 | 4 | 2 | 20 | 23 | 24 | 26 | 18 | 16 | 9 | 147 | ... ... |
| | 3d ..... | . . | 9 | 2 | 5 | 6 | 24 | 23 | 22 | 20 | 21 | *6 | ..... | 138 | ..... |
| 289.. | 1st..... | .... | .... | .... | 8 | 22 | 20 | 17 | 19 | 12 | 20 | 12 | 21 | 151 | 181 |
| | 2d ..... | 14 | 7 | 5 | 16 | 12 | 22 | 16 | 10 | 13 | 13 | 11 | 11 | 150 | ..... |
| 300.. | 1st..... | .... | .... | .... | 19 | 18 | 11 | 17 | 14 | 13 | 17 | 8 | 21 | 138 | 175 |
| | 2d ..... | 20 | 17 | 10 | ... | 3 | 18 | 15 | 13 | 14 | 14 | 12 | 12 | 148 | ..... |

EGG RECORDS FOR TWO YEARS—CONTINUED.

LIGHT BRAHMA.

| Number of hens. | Year. | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | Yields Nov. 1st, 1898, to Nov. 1st, 1899, and Nov. 1st, 1899, to Nov. 1st, 1900. | Yields in first full year of laying. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 52.. | 1st.. . | .... | 11 | 19 | 20 | 21 | 20 | 19 | 20 | 21 | 18 | 19 | 1 | 189 | 194 |
| | 2d ..... | 5 | .. .. | 10 | 4 | 4 | 7 | 6 | 14 | 11 | 4 | 11 | 2 | 78 | ..... |
| 55.. | 1st..... | ... | .... | .... | 1 | 11 | 9 | 3 | 10 | 7 | 8 | 1 | ..... | 55 | 81 |
| | 2d ..... | 2 | 15 | 4 | 5 | .... | .... | .... | .. | .... | ..... | ..... | ..... | 26 | ..... |
| 75.. | 1st. ... | .... | .... | 6 | 14 | 18 | 15 | 15 | 15 | 10 | 9 | 12 | ..... | 114 | 130 |
| | 2d . ... | .... | 12 | 7 | .. | .... | .... | .. | .. | .... | ..... | ..... | 12 | 31 | ..... |
| 116.. | 1st..... | .... | .... | 12 | 18 | 24 | 16 | 12 | 16 | 17 | 15 | 7 | 18 | 155 | 155 |
| | 2d ..... | .... | .... | .... | 4 | 1 | * | .... | .... | .... | ..... | ..... | ..... | 5 | ..... |
| 135.. | 1st..... | .... | .... | 12 | 20 | 21 | 8 | 13 | 25 | 12 | 9 | 14 | ..... | 134 | 155 |
| | 2d . ... | 8 | 13 | ... | 16 | 13 | 22 | 12 | 10 | 17 | 17 | ..... | ..... | 128 | ..... |
| 139.. | 1st..... | ... | .... | 11 | 20 | 19 | 14 | 21 | 19 | 21 | 21 | 22 | 20 | 188 | 194 |
| | 2d ..... | .... | 6 | 5 | * | .... | .... | .. | .. | .... | ..... | ..... | ..... | .... | .... .. |
| 146.. | 1st..... | .... | ... | 11 | 17 | 19 | 12 | 10 | 15 | 13 | 11 | 10 | 13 | 131 | 151 |
| | 2d ..... | 10 | 3 | 17 | 15 | 12 | 14 | 16 | 7 | 10 | 11 | 14 | ..... | 129 | ..... |
| 147.. | 1st..... | ... | .... | 12 | 17 | 20 | 18 | 18 | 16 | 14 | 14 | 13 | 9 | 151 | 151 |
| | 2d . ... | ... | . .. | .... | .... | 9 | 17 | 12 | 11 | 11 | 15 | 1 | ..... | 76 | ... .... |
| 155.. | 1st. ... | .... | .... | ... | 3 | 18 | 24 | 20 | 24 | 14 | 6 | 19 | 21 | 149 | 151 |
| | 2d ..... | 2 | .... | .... | 7 | 3 | 16 | 21 | 18 | 18 | 19 | 19 | 1 | 124 | ..... |
| 276 . | 1st..... | .... | ... | .... | 15 | 15 | 11 | 18 | 13 | 14 | 19 | 8 | ..... | 113 | 124 |
| | 2d ..... | .... | .... | 11 | .... | .... | .... | .... | .... | .... | ..... | ..... | ..... | 11 | ..... |
| 279.. | 1st..... | .... | .. | .... | 14 | 20 | 21 | 20 | 19 | 10 | ..... | . .... | ..... | 104 | 105 |
| | 2d ..... | .... | ... | 1 | .... | .... | . | .... | .... | .... | ..... | ..... | ..... | 1 | ..... .. |
| 282.. | 1st..... | .... | ... | .. | 14 | 23 | 21 | 20 | 20 | 13 | 17 | 17 | ..... | 135 | 138 |
| | 2d ..... | .... | .... | 3 | .... | .... | .... | .... | .... | .... | ..... | ..... | ..... | 3 | .. .... |
| 285.. | 1st..... | .... | .. | .... | 19 | 19 | 20 | 14 | 19 | 17 | 12 | 12 | 20 | 152 | 161 |
| | 2d .... | 8 | .... | 1 | 3 | 1 | 15 | 15 | 9 | 10 | 7 | .. ... | 14 | 83 | ..... |
| 288.. | 1st..... | .... | .... | .... | 15 | 20 | 14 | 13 | 22 | 11 | 17 | 15 | 7 | 134 | 156 |
| | 2d ..... | 7 | 12 | 1 | 9 | 11 | 18 | 20 | 13 | 12 | 18 | 17 | 2 | 138 | ..... |
| 292.. | 1st..... | .... | ... | .. | 21 | 22 | 12 | 17 | 16 | 15 | 16 | 16 | 13 | 148 | 181 |
| | 2d . ... | 13 | 20 | 8 | 2 | 8 | 19 | 15 | 8 | 9 | 8 | 20 | 3 | 133 | ..... |
| 297.. | 1st..... | .... | .. . | ... | 14 | 19 | 19 | 18 | 23 | 16 | 10 | 14 | 16 | 149 | 149 |
| | 2d ..... | .... | .... | .... | 6 | 6 | 15 | 15 | 12 | 9 | 3 | 14 | ..... | 80 | ..... |

WHITE WYANDOTTE.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.. | 1st..... | 20 | 9 | 1 | .... | 17 | 12 | 13 | 15 | 14 | 13 | 9 | 19 | 142 | 142 |
| | 2d ..... | .... | .... | .... | .... | 17 | 17 | 9 | 11 | 11 | 11 | .... | ..... | 76 | ..... |
| 4.. | 1st..... | 20 | .... | 19 | 16 | 22 | 13 | 19 | 22 | 15 | 21 | 19 | 15 | 201 | 201 |
| | 2d ... . | 7 | .. | ... | 7 | 15 | 21 | 21 | 10 | 10 | 17 | 16 | 16 | 140 | .. .... |
| | 3d . .. | 14 | 2 | ... | 6 | 19 | 16 | 17 | 11 | 12 | 9 | 13 | 11 | 130 | ..... |
| 5.. | 1st..... | 14 | .... | 15 | 18 | 8 | 12 | 12 | 15 | 18 | 8 | 9 | 16 | 145 | 145 |
| | 2d ..... | 8 | 13 | 11 | 12 | 8 | 11 | 14 | 18 | 13 | 10 | 7 | 16 | 141 | ..... |
| 8.. | 1st..... | 14 | 17 | 13 | 14 | 18 | 17 | 15 | 11 | 12 | 14 | 15 | 10 | 170 | 170 |
| | 2d ..... | 9 | 16 | 16 | 7 | 2 | 13 | 14 | 8 | 6 | 11 | 7 | 6 | 115 | ..... |
| 12.. | 1st..... | 18 | 10 | 7 | 14 | 14 | 13 | 11 | 12 | 15 | 15 | 9 | 9 | 147 | 147 |
| | 2d ..... | 17 | 6 | 14 | 13 | 15 | 7 | 10 | 9 | 10 | 13 | 10 | 13 | 137 | ... .... |
| 13.. | 1st..... | 9 | ... | .... | 6 | 16 | 11 | 12 | 9 | 12 | 13 | 9 | 12 | 109 | 109 |
| | 2d .. .. | ... | .... | ... | 1 | * | .... | .... | .... | .... | ..... | .... | ... .. | 1 | ..... |
| 14.. | 1st.... | 21 | 20 | 24 | 21 | 19 | 17 | 10 | 18 | 14 | 16 | 15 | 13 | 208 | 208 |
| | 2d ..... | 18 | 22 | 21 | 18 | 15 | 18 | 5 | 13 | 10 | 1 | ..... | ..... | 141 | ..... |
| | 3d ..... | ... | .... | .... | ... | 2 | 12 | 14 | * | .... | ..... | ..... | ..... | 28 | ... .... |
| 19.. | 1st..... | 18 | 13 | 10 | 19 | 9 | 13 | 8 | 16 | 12 | 14 | 14 | 11 | 157 | 157 |
| | 2d . | 5 | .... | 8 | 8 | .... | .... | .... | .... | .... | ..... | ..... | 13 | 34 | ..... |
| 47.. | 1st..... | ... | 12 | 19 | 18 | 19 | 16 | 19 | 17 | 19 | 15 | 14 | 16 | 184 | 200 |
| | 2d . ... | 13 | 13 | 15 | 13 | 7 | 12 | 18 | 17 | 16 | 16 | 14 | 13 | 167 | ..... |
| 50.. | 1st..... | .... | 17 | 19 | 20 | 17 | 19 | 14 | 14 | 13 | 10 | 13 | 5 | 165 | 173 |
| | 2d ..... | 18 | 2 | 2 | 5 | 6 | 11 | 13 | 9 | 11 | 12 | 19 | 3 | 111 | ... ... |
| 87.. | 1st..... | .... | ... | 14 | 18 | 19 | 13 | 16 | 16 | 18 | 16 | 13 | 13 | 156 | 158 |
| | 2d ..... | 1 | 1 | 8 | 11 | 9 | 10 | 9 | 10 | 9 | 10 | 6 | ..... | 84 | ..... |
| 96.. | 1st..... | .... | .... | 9 | 16 | 17 | 14 | 12 | 15 | 13 | 11 | 13 | 12 | 132 | 161 |
| | 2d ..... | 9 | 15 | 16 | 14 | 15 | 18 | 9 | 9 | 10 | 12 | 11 | ..... | 138 | ..... |
| 102.. | 1st..... | 13 | 16 | 13 | 20 | 12 | 14 | 14 | 13 | 9 | 5 | 13 | 1 | 143 | 144 |
| | 2d ..... | 13 | 1 | .... | .. .. | .... | .... | .... | .... | .... | ..... | . .... | .... | 14 | ..... |

EGG RECORDS FOR TWO YEARS—CONCLUDED.

WHITE WYANDOTTE.

| Number of hens. | Year. | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | Yields Nov. 1st, 1898, to Nov. 1st, 1899, and Nov. 1st, 1899, to Nov. 1st, 1900. | Yields in first full year of laying. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 105.. | 1st..... | .... | .... | 15 | 13 | 18 | 8 | 11 | 15 | 15 | 13 | 11 | 19 | 138 | 157 |
| | 2d ..... | 8 | 11 | .... | .... | 9 | 14 | 13 | ... | .... | ..... | ..... | ..... | 55 | ..... |
| 131.. | 1st..... | .... | .... | 11 | 19 | 17 | 11 | 17 | 14 | 12 | 11 | 12 | 11 | 135 | 147 |
| | 2d ..... | 8 | 2 | 14 | 6 | 6 | 15 | .... | 9 | 7 | 9 | 9 | 9 | 94 | ..... |
| 134.. | 1st..... | .... | .... | 9 | 16 | 16 | 17 | 14 | 16 | 14 | 10 | 15 | 6 | 133 | 165 |
| | 2d ..... | 16 | 16 | 15 | 8 | 13 | 12 | 14 | 7 | 6 | 8 | 12 | 9 | 138 | .... ... |
| 173.. | 1st. ... | .... | .... | 12 | 20 | 14 | 12 | 16 | 16 | 13 | 6 | 13 | 12 | 134 | 153 |
| | 2d ..... | 11 | 7 | 11 | 14 | 9 | 11 | 14 | 11 | 7 | 10 | 7 | 4 | 116 | ..... |
| 224.. | 1st.... | .... | .... | 1 | 19 | 10 | 16 | 15 | 14 | 18 | 16 | 14 | 8 | 131 | 167 |
| | 2d ..... | 12 | 14 | 12 | 8 | 12 | 12 | 12 | 13 | 15 | 11 | 6 | 12 | 139 | ..... |
| 242.. | 1st. ... | .... | .... | .... | 15 | 24 | 13 | 16 | 16 | 17 | 14 | 12 | 14 | 141 | 167 |
| | 2d ..... | 12 | 14 | 12 | 8 | 12 | 12 | 12 | 13 | 15 | 11 | 6 | 12 | 139 | ..... |
| 272.. | 1st..... | .... | .... | .... | 7 | 19 | 17 | 6 | 15 | 14 | 11 | 7 | 19 | 115 | 115 |
| | 2d . ... | ... | .... | .... | .... | 8 | ... | 13 | 12 | * | ..... | ..... | ..... | 33 | ..... |
| 280.. | 1st..... | ... | .... | .... | 5 | 1 | 13 | 23 | 18 | 21 | 15 | 21 | 21 | 138 | 170 |
| | 2d ..... | 17 | 15 | 9 | 5 | 11 | 14 | 9 | 2 | ... | ..... | ..... | ..... | 82 | ..... |
| 287.. | 1st..... | .... | ... | .. | 18 | 15 | 11 | 17 | 8 | 17 | 14 | 10 | 9 | 119 | 148 |
| | 2d ..... | 10 | 14 | 5 | .... | ... | .... | .... | .... | .... | ..... | .... | 9 | 38 | .. ..... |
| 290.. | 1st. ... | ... | ... | .... | 16 | 12 | 15 | 14 | 12 | 13 | 14 | 14 | 11 | 121 | 162 |
| | 2d . ... | 13 | 20 | 8 | 2 | 8 | 19 | 15 | 8 | 9 | 8 | 20 | 3 | 133 | ..... |

Every hen that has laid large numbers of eggs through the first or the first and second years, has shown much vigor and constitution. Some individuals have laid heavily for a few months and then drooped and died, seemingly because they could not stand the heavy work.

There have been two hens in the pens all of the last year that we have every reason to suppose have never laid an egg. It is possible that they may have laid, but with the close watching they have had it is not probable. They are well formed and have always been in good thrift and health so far as appearances have indicated.

In the first table following, the yields of 67 hens are given for two years forward from November 1, 1898, and the records of four of them are continued through the third year. These are not all of the hens tested in 1898, but they are the only ones retained during the second year. Some of them were the best and others among the poorer layers of that year.

Of the four that layed over 200 eggs during the first 12 months after commencing, No. 4 laid 201 eggs the first year, 140 the second and 130 the third year, and she is now on

her fourth year's work. No 14 laid 208 eggs the first year, 141 the second and 28 the third year. She moulted in July, 1900, and met with an accident in August which came very near ending her existence, but her great vitality enabled her to rally and she shed her feathers again, completely, and grew a second suit that season. She did not begin laying again until the following March when she laid 28 eggs by the close of May. At moulting time in June she died. She was an upheaded, strong hen and the first one to give us over two hundred eggs in one year. No. 101 laid 201 large brown eggs the first year; 30 the second year and 63 the third year. She is now on her fourth year's work. No. 286 was a late hatched pullet and did not commence laying until February 12, 1899. In a year forward from that date she laid 206 eggs. In the first year, commencing November 1, 1899, she laid 191 eggs, with 157 during the second, and 138 in her third year. When nearly three and a half years old she died suddenly, having laid 119 eggs during the last 160 days she lived.

With many poultry keepers and farmers the idea is prevalent that if a hen lay but few eggs the first year she is likely to do better the second year than though she laid well during the first year. The data so far secured does not show that hens that yield 120 eggs or less the first year yield satisfactorily the second year. Those that yielded in the vicinity of a hundred or less the first year yielded very light the second year. On the other hand many of those that yielded from 130 to 200 or over during the first year laid quite well the second year.

Of the 67 hens carried through two years, 10 laid more eggs during the second than the first year, and 57 laid more during the first than the second year.

The right hand column of the tables shows the number of eggs laid by each bird during the first full year after she commenced laying, and in most cases it is larger than when the year is reckoned forward from November 1st. We have found it necessary to have the pullets, of the breeds we have used, hatched by the middle of April, at the latest, in order to have them laying by the first of November. They then have a full year for work, before they are removed, the following fall, to make room for the new pullets that must be in winter quarters early, if they are to do satisfactory work. If the pullet does not commence laying until January, she does not have a full year before she has to give way to the young stock by the last of October or the first of Novem-

ber. This feature counts for a great deal and the two right hand columns of the tables are worthy of careful study.

RECORDS OF PULLETS, 1899-1900.

On November 1st, 1899, 180 pullets of the three breeds previously mentioned were put into winter quarters and records kept with them during the twelve months following. The pens and yards in which they were confined were the same as those occupied by the hens in the preceding test. The pens are 10 by 16 feet in size in the clear space and each one has four of the Station trap nests in it as descriped in the Station reports of 1897 and 1898. Twenty pullets and two cockerels were kept in each lot.

The birds were fed throughout the year, daily as follows:— Each pen of 22 received one pint of wheat, in the deep litter early in the morning. At 9.30 A. M. one-half pint of oats was fed to them in the same way. At 1 P. M. one-half pint of cracked corn was given in the litter as before. At 3 P. M. in winter and 4 P. M. in the summer they were given all the mash they would eat up clean, in half an hour.

The mash was made of the following mixture of meals:— 200 pounds wheat bran; 100 pounds corn meal; 100 pounds wheat middlings; 100 pounds linseed meal; 100 pounds meat meal or fine meat scraps. Part of the year the linseed meal was omitted, and the amount of meat meal was doubled. The mash contained one-fourth of its bulk of clover leaves and heads, secured from the feeding floor in the cattle barn. The- clover was thoroughly soaked with hot water. The mash was made quite dry. Cracked bone, oyster shell, clean grit and water were at all times before them. Two large mangolds were fed to the birds in each pen daily in winter, and green food in plenty in summer. Very few soft-shelled eggs are produced and we have not known of an egg being eaten by the hens during the three years in which the trap nests have been used. Ffteen birds died during the year and nine were stolen.

A few eggs had been laid in the litter on the floor but no birds have received credit for eggs not laid in the nest. By reference to the table following it will be seen that many birds did not commence laying until some two months after others were at work. They were mainly the later hatched ones and

illustrate forcibly the necessity for early hatched stock if a full year's work is to be gotten from it by November first.

10,611 eggs were laid in the nests by the Plymouth Rocks to October 31st—an average of 132 to each bird. Ten of the 80 died or were stolen and did not work a full year, but no deductions are made on that account.

No. 303 laid 208 eggs, and 127 in the following year. No. 326 laid 211, and 145 during the next year. No. 318 laid 237 good brown eggs in the year, and 102 the second year. After she had laid 200 the next dozen were saved as produced and found to weigh 1 pound, 11¼ ounces.

In the same pens receiving the same treatment as the foregoing and of the same breed, were Nos. 347, 361 and 375 and they yielded respectively 32, 42 and 36 eggs in the same time that their mates were doing their greatest work.

9,844 eggs were laid by the 80 White Wyandotte hens up to October 31st. Ten of their numbers died or were stolen during the year, but no allowance is made for their short work. The 80 averaged 123 eggs each. No. 403 laid 209 eggs to October 31st and in the full year after she commenced laying she laid 219. The second year she laid 162 eggs. No. 428 laid 217 to October 31st and in the full year 219. During the second year she laid 138. No. 445 laid 208 to October 31st and 219 to the close of her full year. The next year she yielded 139 eggs. No. 480 laid 214 to Oct. 31st and 218 at the close of full year. During the next year she gave 172 eggs. The poorest laying was done by Nos. 411; 462; 474; 475 and 478, their yields being respectively 62; 22; 41; 10 and 66 to October 31st. Although these poorer layers looked well when they were pullets, as they grew older several of them showed low vitality.

The twenty Brahmas laid 2018 eggs to Oct. 31st, an average of nearly 101 eggs each. None of them reached the two hundred limit. Four either died or were stolen in the eighth and ninth months forward from Nov. 1st. The poorest laying for the year was done by No. 485. She gave a total yield of 2 eggs. While she was not a producer there was nothing in her looks or appearance to indicate that she was a drone. As the season advanced she became fleshy but she was not of the fleshy type at the commencement or during the early months of the year.

The following tables show the work of the individual birds by months and the totals.

## EGG RECORDS OF HENS HATCHED BETWEEN APRIL 1 AND MAY 16, 1899.

### BARRED PLYMOUTH ROCKS.

| Number of hen. | 1899. | | 1900. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | Total. |
| 301... | 16 | 14 | 16 | 11 | 9 | 16 | † | ..... | ... .. | . ... | ..... | ..... | 82 |
| 302... | ..... | 7 | 22 | 14 | 18 | 17 | 8 | 24 | 14 | 13 | 16 | 14 | 167 |
| 303... | 8 | 17 | 22 | 5 | 12 | 20 | 25 | 26 | 21 | 21 | 21 | 16 | 208 |
| 304... | 17 | 20 | 19 | 7 | 11 | 20 | 25 | 3 | 19 | 17 | 16 | 1 | 175 |
| 305... | 11 | 22 | 19 | 14 | 16 | 5 | 14 | 15 | 14 | 16 | 11 | 14 | 171 |
| 306... | ..... | 16 | 12 | ..... | ..... | 18 | 5 | 4 | ..... | ..... | ..... | 6 | 61 |
| 307... | 2 | 15 | 21 | 16 | 18 | 19 | 20 | 9 | 12 | 12 | 15 | 13 | 175 |
| 308... | ..... | 10 | 21 | 14 | 15 | 19 | 11 | 14 | 12 | * | ..... | ..... | 116 |
| 309... | 14 | 13 | 24 | 18 | 20 | 20 | 22 | 19 | 19 | 14 | ..... | ..... | 183 |
| 310... | ..... | 2 | 2 | ..... | 7 | 15 | 18 | 5 | 16 | 3 | ..... | ..... | 68 |
| 311... | 6 | 21 | 25 | 22 | 22 | 14 | 17 | 12 | 13 | 4 | 19 | 10 | 185 |
| 312... | 1 | 10 | 13 | ..... | 12 | * | ..... | ..... | ..... | ..... | ..... | .... | 36 |
| 313... | ..... | .... | 21 | 10 | 15 | 19 | 5 | ... | ..... | ..... | ..... | ..... | 70 |
| 314... | 5 | — 8 | 14 | 13 | 11 | 13 | 9 | 6 | * | ..... | .... | ..... | 79 |
| 315... | ..... | 7 | 19 | .... | 6 | 5 | 13 | * | ..... | ..... | ..... | ..... | 50 |
| 316... | 8 | 23 | 24 | 18 | 21 | 18 | 22 | 12 | 22 | 17 | 13 | * | 198 |
| 317... | 6 | 22 | 25 | 18 | 19 | 18 | † | ..... | . ... | ..... | ..... | .. .. | 108 |
| 318... | 18 | 22 | 25 | 21 | 22 | 24 | 23 | 22 | 25 | 17 | 16 | 2 | 237 |
| 319... | ..... | 12 | 15 | 2 | 6 | 14 | 10 | . .... | ..... | ..... | ..... | ..... | 59 |
| 320... | ... . | 18 | 7 | 20 | 13 | 17 | 12 | 9 | 10 | 12 | 7 | 8 | 133 |
| 321... | . .. | ..... | 13 | 16 | 20 | 18 | 17 | 22 | 15 | 21 | 18 | 10 | 170 |
| 322... | 6 | 8 | 18 | 3 | 13 | 7 | 9 | 4 | ..... | ..... | ..... | .. .. | 68 |
| 323... | .. | ..... | 11 | 14 | 20 | .... | 20 | 18 | 20 | 21 | 21 | 13 | 158 |
| 324... | 12 | 16 | 17 | 13 | 6 | 21 | 17 | 14 | 12 | 20 | 6 | 9 | 163 |
| 325... | ..... | 15 | 22 | 15 | 13 | 11 | 10 | 3 | 13 | 7 | 11 | ..... | 120 |
| 326... | 13 | 21 | 21 | 18 | 16 | 22 | 16 | 16 | 16 | 15 | 14 | 23 | 211 |
| 327... | ..... | 19 | 22 | 7 | 4 | 9 | 13 | 3 | 2 | * | ..... | ..... | 79 |
| 328... | ..... | 18 | 14 | 15 | 11 | 15 | ..... | 17 | 12 | 11 | 9 | 16 | 138 |
| 329... | ..... | ..... | 21 | 10 | 15 | 20 | 19 | 15 | 10 | 11 | 13 | ..... | 134 |
| 330... | 8 | 18 | 26 | 17 | 18 | * | ..... | ..... | ..... | ..... | .. ... | ..... | 87 |
| 331... | 4 | 22 | 20 | 16 | 9 | 15 | 20 | 16 | † | ... .. | ..... | ..... | 121 |
| 332... | ... . | 14 | 24 | 3 | 20 | 20 | 18 | 11 | 15 | 21 | 13 | ..... | 159 |
| 333... | ..... | ..... | 14 | 17 | 22 | 20 | 22 | 14 | 7 | 8 | 11 | 9 | 144 |
| 334... | 2 | 20 | 23 | 11 | 12 | 22 | 20 | 20 | 22 | 20 | 8 | ..... | 180 |
| 335... | ..... | ..... | 19 | 8 | 8 | 10 | 10 | 13 | 7 | 7 | 8 | 8 | 98 |
| 336... | ..... | 6 | 19 | 3 | 17 | 21 | 23 | 11 | 17 | 17 | 3 | .... | 137 |
| 337... | 14 | 22 | 18 | 7 | 12 | 15 | 15 | 11 | 9 | 17 | 15 | 8 | 163 |
| 338... | ..... | 15 | 16 | 2 | 7 | 24 | 18 | 12 | 13 | 23 | 1 | ..... | 131 |
| 339... | ..... | 1 | 23 | ..... | 8 | 11 | 12 | 11 | 9 | 13 | ..... | ..... | 88 |
| 340... | 8 | 28 | 25 | 19 | 14 | 13 | 14 | 16 | 8 | 12 | 17 | 7 | 181 |
| 341... | 1 | 22 | ..... | 5 | 13 | 17 | 18 | 14 | 14 | 11 | 5 | 14 | 134 |
| 342... | ..... | .. . | 16 | 11 | 10 | 21 | 17 | 12 | 14 | 12 | 4 | 8 | 125 |
| 343... | 14 | 24 | 17 | 14 | 9 | 20 | 14 | 16 | 12 | 17 | 8 | 13 | 178 |
| 344... | ..... | ..... | 13 | 13 | 14 | 20 | 22 | 23 | 17 | 19 | 19 | 6 | 166 |
| 345... | 12 | 19 | 20 | 18 | 19 | 17 | 13 | 2 | 11 | 11 | 11 | .... | 153 |
| 346... | 8 | 17 | 22 | 11 | 11 | 12 | 13 | 13 | 12 | 9 | 7 | 15 | 150 |
| 347... | ..... | ..... | 8 | ..... | 12 | 11 | 1 | ..... | ..... | ..... | ..... | ..... | 32 |
| 348... | ..... | ..... | 16 | 17 | 19 | 20 | 18 | 16 | 15 | 12 | 13 | 6 | 152 |
| 349... | ..... | ..... | 5 | 7 | 3 | 14 | 21 | 20 | 16 | 9 | 5 | * | 100 |
| 350... | . ... | 19 | 21 | 17 | 19 | 14 | 17 | 15 | 12 | 17 | 12 | 15 | 176 |
| 351... | 2 | 22 | 21 | 1 | 14 | 10 | 13 | 14 | 10 | 9 | 13 | ..... | 129 |
| 352... | 7 | 17 | 14 | 11 | 16 | 16 | 16 | 12 | 11 | 11 | 14 | 12 | 153 |
| 353... | 17 | 14 | 24 | 16 | 18 | 20 | 20 | 15 | 14 | 13 | 8 | 19 | 193 |
| 354... | ..... | ... . | 9 | 7 | 10 | 22 | 18 | 19 | 18 | 1 | .... | ... | 104 |
| 355... | .... | ..... | 3 | ..... | 3 | 17 | 11 | 13 | 12 | 7 | 10 | ..... | 76 |
| 356... | ..... | ..... | 15 | 2 | 9 | 19 | 22 | 13 | 15 | 13 | 19 | 5 | 132 |
| 357... | 21 | 2 | 23 | 15 | 21 | 21 | 18 | 16 | 17 | 13 | 10 | 4 | 181 |
| 358... | 18 | 17 | 21 | 9 | 9 | 17 | 11 | 15 | 8 | 9 | 13 | ..... | 147 |
| 359... | 8 | 2 | 21 | 17 | 16 | 17 | 16 | 15 | 16 | 16 | 11 | 16 | 170 |
| 360... | ..... | ..... | 18 | 8 | 16 | 13 | 10 | 9 | 11 | 10 | 11 | 9 | 115 |

* Dead. † Stolen.

EGG RECORDS—CONTINUED.

BARRED PLYMOUTH ROCKS.

| Number of hen. | 1899. | | 1900. | | | | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | |
| 361 | ..... | ..... | ..... | .... | 4 | 2 | 4 | 14 | 8 | ..... | 8 | 2 | 42 |
| 362 | ..... | ..... | 18 | 8 | 6 | 19 | 19 | 15 | 5 | .... | .. .. | .... | 90 |
| 363 | ..... | ..... | 12 | 9 | 13 | 17 | 15 | 14 | 11 | 8 | 12 | 6 | 117 |
| 364 | 4 | 14 | 11 | 12 | 11 | 16 | 22 | 19 | 20 | 12 | 18 | 15 | 174 |
| 365 | ..... | 8 | 22 | 15 | 21 | 25 | 21 | 20 | 15 | 23 | 9 | ..... | 179 |
| 366 | ..... | 5 | 10 | ..... | 15 | 16 | 8 | 8 | 11 | 10 | 6 | .. ... | 89 |
| 367 | ..... | ... . | 24 | 21 | 17 | 14 | 11 | 9 | 14 | 16 | 10 | 5 | 141 |
| 368 | 15 | 16 | 22 | 7 | 16 | 15 | 16 | 3 | 8 | 9 | 14 | 5 | 145 |
| 369 | 9 | 18 | 10 | 4 | 9 | 14 | 21 | 9 | 10 | 15 | ..... | 16 | 135 |
| 370 | 4 | 23 | 21 | 7 | 4 | 8 | 11 | 2 | ..... | ..... | ... | .... | 80 |
| 371 | 9 | 18 | 22 | 21 | 24 | 21 | 11 | 7 | 2 | 11 | 2 | 1 | 149 |
| 372 | ..... | ..... | 2 | ..... | 1 | 13 | 24 | ..... | 10 | 5 | ..... | ..... | 55 |
| 373 | ..... | ..... | 14 | ..... | 10 | 17 | 24 | 20 | 21 | 21 | 12 | 2 | 141 |
| 374 | 11 | 16 | 16 | 7 | 16 | 18 | 16 | 14 | 9 | 8 | 8 | 3 | 139 |
| 375 | ..... | ..... | 19 | 16 | ..... | ..... | 6 | 1 | . ... | ..... | ..... | ..... | 36 |
| 376 | ..... | 20 | 22 | 2 | 17 | 11 | 12 | 10 | 9 | 11 | 12 | 2 | 128 |
| 377 | 6 | 20 | 15 | ..... | 11 | 16 | 16 | 15 | 15 | 13 | 10 | 6 | 143 |
| 378 | 5 | 15 | 24 | 19 | 22 | 21 | 17 | 15 | 14 | 13 | 2 | ..... | 163 |
| 379 | ..... | ..... | 15 | 10 | 7 | 21 | 11 | 18 | 13 | 14 | 14 | ..... | 129 |
| 380 | ..... | ..... | ..... | 1 | 2 | 5 | 11 | 16 | 16 | 16 | 18 | 15 | 100 |
| 381 | ..... | ..... | 9 | 14 | 15 | 21 | 22 | 20 | 15 | 20 | 19 | 14 | 169 |

WHITE WYANDOTTES.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 401 | . .... | 12 | 20 | 16 | 9 | 17 | 16 | 11 | 16 | 11 | ..... | ..... | 128 |
| 402 | 12 | 1 | 11 | 22 | 17 | 19 | † | ..... | ..... | ..... | ..... | .... | 82 |
| 403 | 4 | 25 | 26 | 17 | 21 | 18 | 21 | 16 | 13 | 14 | 16 | 18 | 209 |
| 404 | 3 | 24 | 12 | ..... | 13 | 16 | 12 | 10 | 16 | 9 | 13 | 15 | 142 |
| 405 | * | ..... | ..... | . ... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 406 | 17 | 22 | 16 | 13 | 20 | 13 | 17 | 14 | 12 | 10 | 12 | .... . | 166 |
| 407 | .. . | ..... | 8 | .. .. | 11 | 19 | 19 | 16 | 11 | 6 | 5 | 9 | 104 |
| 408 | 6 | 22 | 22 | 15 | 9 | 22 | 17 | 16 | 14 | 17 | 11 | 8 | 179 |
| 409 | ..... | 16 | 21 | 11 | 9 | 15 | † | ..... | ..... | .... . | ..... | . ... | 72 |
| 410 | 8 | 15 | 23 | 20 | 24 | 22 | 13 | 19 | 17 | .. ... | 16 | 19 | 195 |
| 411 | 6 | 14 | 14 | 3 | 14 | 11 | ... . | ..... | ..... | ..... | ..... | ..... | 62 |
| 412 | 8 | 16 | 16 | 19 | 15 | 18 | 18 | 9 | 14 | 17 | 13 | 19 | 178 |
| 413 | * | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | .... | ..... |
| 414 | 4 | 17 | 19 | 16 | 18 | 12 | 13 | 13 | 11 | 11 | 7 | 8 | 149 |
| 415 | 5 | 19 | 18 | 10 | 15 | 9 | 22 | 16 | 16 | 3 | 11 | 11 | 155 |
| 416 | 14 | 2 | 13 | 10 | 12 | 19 | 11 | 15 | 11 | 9 | 3 | 10 | 129 |
| 417 | ..... | 12 | 22 | 15 | 7 | 11 | † | ..... | ..... | .... | ..... | ..... | 67 |
| 418 | ..... | 17 | 20 | 1 | 21 | 13 | 13 | 15 | 14 | 7 | 7 | ..... | 128 |
| 419 | .... | ..... | 15 | 11 | 21 | 15 | 17 | 5 | 11 | 9 | 9 | .... | 113 |
| 420 | .... | | 1 | 17 | 22 | 18 | 20 | 5 | ..... | ..... | ..... | ..... | 83 |
| 421 | 7 | 13 | 18 | 6 | 10 | 5 | 12 | 9 | 11 | 16 | 11 | ..... | 108 |
| 422 | 11 | 21 | 14 | 11 | 14 | 17 | 15 | 11 | 12 | 3 | * | ..... | 129 |
| 423 | ..... | 4 | 19 | 9 | 12 | 20 | 20 | 15 | 9 | 1 | 10 | 1 | 120 |
| 424 | ..... | .... | 11 | 13 | 15 | 15 | 16 | 14 | 11 | 16 | 4 | ..... | 115 |
| 425 | ..... | 13 | 24 | 21 | 22 | 22 | 24 | 10 | 10 | 11 | 16 | ..... | 173 |
| 426 | ..... | 9 | 20 | 17 | 13 | 13 | 15 | 12 | 13 | 10 | 3 | ..... | 125 |
| 427 | ..... | ..... | 3 | 14 | 19 | 16 | 15 | 11 | 12 | 10 | ..... | .... . | 100 |
| 428 | 13 | 22 | 21 | 19 | 21 | 24 | 25 | 14 | 14 | 18 | 5 | 21 | 217 |
| 429 | 2 | 16 | 15 | 16 | 16 | 17 | 10 | 1 | .... | .... | ..... | ..... | 93 |
| 430 | ..... | ..... | 21 | 16 | 18 | 20 | 16 | *6 | ..... | ..... | .. ... | ..... | 97 |
| 431 | 3 | 18 | 23 | 18 | 10 | 19 | 20 | 15 | 18 | 14 | 7 | 17 | 179 |
| 432 | .... . | ..... | 15 | 12 | 14 | 10 | 16 | 2 | * | ..... | ..... | ..... | 69 |
| 433 | 9 | 22 | 5 | 13 | 15 | 16 | 10 | 15 | 15 | 4 | 18 | 6 | 147 |
| 434 | 2 | 20 | 18 | 16 | 13 | 16 | 11 | 14 | 13 | 10 | 11 | ..... | 144 |
| 435 | ..... | ..... | 19 | 18 | 13 | 23 | 17 | 13 | 14 | 9 | 24 | 14 | 164 |
| 436 | ..... | 2 | 14 | 8 | 6 | 17 | 21 | 20 | 7 | 12 | ..... | ... .. | 107 |

*Dead. †Stolen.

EGG RECORDS—CONTINUED.

WHITE WYANDOTTES.

| Number of hen. | 1899. | | 1900. | | | | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | |
| 437... | ..... | . ... | 7 | 17 | 21 | 22 | 21 | 21 | 14 | 7 | 18 | 8 | 156 |
| 438... | 2 | 18 | 6 | 5 | 13 | 11 | 15 | 8 | 7 | 6 | 8 | ..... | 99 |
| 439... | 6 | 22 | 21 | 9 | 19 | 15 | 16 | 14 | 19 | 6 | 6 | 15 | 163 |
| 440... | 15 | 24 | 18 | 20 | 21 | 22 | 22 | 11 | * | ..... | ..... | ..... | 153 |
| 441... | ..... | ..... | 16 | 12 | 11 | 11 | 13 | 7 | 13 | ..... | 16 | 18 | 117 |
| 442... | 8 | 12 | 15 | 10 | 15 | 18 | 18 | 16 | 19 | 16 | 16 | 8 | 171 |
| 443... | ..... | ..... | 13 | 11 | 8 | 8 | 19 | 21 | 16 | 16 | 17 | 16 | 142 |
| 444... | ..... | ..... | 4 | 19 | 11 | 19 | 14 | 12 | 13 | 13 | 3 | 19 | 120 |
| 445... | 7 | 23 | 25 | 21 | 15 | 21 | 19 | 12 | 19 | 17 | 11 | 20 | 208 |
| 446... | 2 | 25 | 15 | ..... | 9 | 16 | 15 | 12 | 15 | 16 | 11 | 20 | 153 |
| 447... | ..... | 6 | 20 | 8 | ... | 5 | 10 | 9 | 9 | 11 | 10 | 10 | 98 |
| 448... | 10 | 11 | 23 | 19 | 20 | 15 | 18 | 11 | 13 | 13 | 15 | 7 | 175 |
| 449... | ..... | ..... | 10 | 12 | 14 | 15 | 11 | 12 | 15 | 7 | 8 | ..... | 104 |
| 450... | ..... | ..... | 12 | 12 | 1 | 12 | 11 | 8 | 10 | 7 | 12 | 2 | 87 |
| 451... | 5 | 23 | 23 | 19 | 13 | 19 | 22 | 12 | 18 | 23 | 14 | 5 | 196 |
| 452... | ..... | ..... | 15 | 9 | 15 | 14 | 16 | 4 | 10 | 11 | 13 | ..... | 107 |
| 453... | ..... | ..... | 6 | 13 | 9 | 6 | 8 | 10 | 9 | ..... | ..... | ..... | 61 |
| 454... | 16 | 26 | 5 | 13 | 6 | 2 | ..... | ..... | ..... | .... | ..... | ..... | 68 |
| 455... | 12 | 22 | 23 | 18 | 15 | 18 | 17 | 12 | 16 | 9 | 15 | 16 | 193 |
| 456... | 13 | 18 | 18 | 3 | 16 | 13 | 17 | 10 | ..... | 13 | 4 | 12 | 136 |
| 457... | ..... | ..... | 14 | 14 | 9 | 7 | 10 | 8 | 8 | 8 | ..... | ..... | 78 |
| 458... | 3 | 21 | 20 | 15 | 15 | 5 | 13 | 12 | 8 | 8 | ..... | ..... | 120 |
| 459... | ..... | 16 | 22 | 19 | 16 | 22 | 16 | 12 | 12 | 16 | 10 | 19 | 180 |
| 460... | ..... | 12 | 20 | 13 | 13 | 10 | 13 | 12 | 12 | 11 | ..... | 10 | 126 |
| 461... | 9 | 23 | 7 | 14 | 18 | 19 | 17 | 11 | 13 | 10 | 14 | 23 | 178 |
| 462... | ..... | ..... | 10 | 1 | ..... | 11 | ..... | .... | ... . | ... .. | .... | ..... | 22 |
| 463... | ..... | .... | 12 | 16 | 18 | 9 | ..... | 8 | 14 | 5 | 15 | 11 | 108 |
| 464... | ..... | ..... | 10 | 3 | 10 | ..... | 5 | 16 | 14 | 6 | 4 | ..... | 68 |
| 465... | ..... | 21 | 12 | ..... | 14 | 14 | 13 | 10 | 11 | 10 | 11 | 3 | 119 |
| 466... | ..... | . ... | 16 | 18 | 23 | 9 | † | ..... | ..... | ..... | ..... | ..... | 66 |
| 467... | ... | 21 | 23 | 15 | 9 | 14 | 9 | 5 | 5 | 12 | 7 | 10 | 130 |
| 468... | .... | ..... | 7 | 19 | 18 | 19 | 17 | 19 | 19 | 12 | 19 | 22 | 171 |
| 469... | 12 | 22 | 22 | 11 | .... | 3 | ..... | 11 | 9 | 14 | 12 | 11 | 127 |
| 470... | ..... | ..... | 20 | 12 | 19 | 20 | 15 | 14 | 22 | 8 | 7 | 4 | 141 |
| 471... | ..... | ..... | 17 | 19 | ... .. | 16 | 13 | 14 | 5 | 3 | ..... | .... | 87 |
| 472... | ..... | ..... | 3 | 13 | 17 | 16 | 11 | 8 | 10 | .... | ..... | ..... | 78 |
| 473... | ..... | 18 | 19 | ..... | 13 | 12 | 17 | 10 | 8 | 10 | 7 | 4 | 118 |
| 474... | ..... | ..... | 6 | 13 | 12 | ..... | 8 | 2 | ..... | ..... | ..... | ..... | 41 |
| 475... | ..... | ..... | 3 | .... | ..... | 2 | 3 | ..... | ..... | 1 | ..... | 1 | 10 |
| 476... | ..... | 3 | 24 | 12 | 12 | 20 | 14 | 14 | 11 | 12 | 5 | 5 | 132 |
| 477... | 3 | 20 | 22 | 11 | 17 | 13 | 14 | 9 | 12 | 10 | 13 | 13 | 156 |
| 478... | ..... | ..... | 10 | 5 | 19 | ..... | 16 | 16 | ..... | ..... | ..... | ..... | 66 |
| 479... | ..... | 14 | 23 | 18 | 13 | 13 | 20 | 12 | 16 | 9 | 14 | 17 | 167 |
| 480... | 16 | 24 | 23 | 19 | 17 | 21 | 17 | 20 | 17 | 15 | 15 | 10 | 214 |

LIGHT BRAHMAS.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 481... | ..... | 21 | 21 | 7 | 2 | 17 | 19 | 13 | 11 | 6 | 11 | 10 | 138 |
| 482... | 7 | 17 | 3 | 17 | 4 | 14 | 9 | 5 | 11 | ..... | 15 | 12 | 114 |
| 483... | ..... | 18 | 9 | 12 | 5 | 11 | 15 | 3 | 10 | ..... | ..... | ..... | 83 |
| 484... | 4 | 21 | 16 | 14 | 9 | 17 | 23 | 18 | 14 | 7 | ..... | ..... | 143 |
| 485... | ..... | ..... | 1 | ..... | ..... | ..... | 1 | ..... | ..... | ..... | ..... | ..... | 2 |
| 486... | 7 | 16 | 12 | 4 | 4 | 16 | 16 | 12 | 17 | 10 | 14 | 10 | 138 |
| 487... | ..... | 19 | 20 | 10 | 10 | 16 | 14 | 6 | 12 | .... | 14 | 6 | 127 |
| 488... | ..... | 10 | 18 | ..... | ..... | ..... | ..... | 11 | 21 | 18 | 12 | ..... | 90 |
| 489... | ..... | ..... | 4 | 9 | 1 | 16 | 19 | 9 | 11 | 12 | 14 | ..... | 95 |
| 490... | 4 | 22 | 19 | 7 | 7 | 17 | 6 | 5 | † | ..... | ... | ..... | 87 |
| 491... | 2 | 18 | 18 | 16 | 8 | 17 | 16 | 20 | 19 | 19 | 10 | 1 | 164 |
| 492... | ..... | 15 | 15 | 3 | 4 | ..... | 17 | 13 | 13 | 16 | 3 | ..... | 99 |

* Dead. † Stolen.

EGG RECORDS—CONCLUDED.

LIGHT BRAHMAS.

| Number of hen. | 1899. | | 1900. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | Total. |
| 493... | ..... | .... | 4 | 13 | 5 | 16 | 10 | 13 | 13 | 14 | 7 | 12 | 107 |
| 494... | ..... | 18 | 18 | 5 | 10 | 18 | 11 | * | ..... | .... | ..... | ..... | 80 |
| 495... | 13 | 20 | 4 | 6 | 1 | 18 | 13 | 1 | † | ..... | .... | ..... | 76 |
| 496... | ..... | 4 | 14 | 4 | 15 | 7 | 11 | 7 | * | ..... | ..... | ..... | 62 |
| 497... | ..... | 13 | 13 | 15 | 12 | 16 | 12 | 12 | 8 | 8 | 9 | ..... | 118 |
| 498... | ..... | ..... | 2 | 2 | .... | ..... | 2 | 2 | ..... | 3 | 7 | ..... | 18 |
| 499... | ..... | 8 | 7 | 3 | 6 | 17 | 22 | 22 | 17 | 17 | 10 | 18 | 147 |
| 500... | 14 | 21 | 18 | ..... | 14 | 11 | 12 | 8 | 14 | 2 | 9 | 7 | 130 |

* Dead. † Stolen.

RECORDS OF PULLETS, 1900-1901.

On November 1, 1900, 100 April and May hatched Barred Plymouth Rock pullets, and 90 White Wyandotte pullets hatched at the same time were put into the house previously described and treated in the same manner that their predecessors had been during the two preceding years.

Fourteen of the Rocks and 17 of the Wyandottes died during the year. There was no evidence of disease among them. Up to October 31, 1901, the hundred Plymouth Rocks laid 13,200 eggs; an average of 132 to each bird. Six birds yielded from 200 to 234 eggs each to October 31st, and in the same pens were six of their mates that laid only between 23 and 70 eggs each. There were six others that yielded over 200 eggs each before the first year of their laying was completed, making 12 hens that each laid 200 eggs or over, during the first year, out of the 100 put in to the test at the commencement of the year. The best work by any hen since we have been selecting the breeding stock by the present method was done this year by No. 617 who gave her first egg November 29, 1900, and to November 28, 1901, she had laid 251 eggs.

The ninety White Wyandottes laid 11,184 eggs to Oct. 31, an average of 124 to each one. Six birds yielded from 203 to 233 eggs each. The six poorest layers gave yields between 36 and 65 eggs each. The following tables show the monthly yields for this year.

## EGG RECORDS OF HENS HATCHED DURING APRIL AND MAY, 1900.

### BARRED PLYMOUTH ROCKS.

| Number of hen. | 1900. | | 1901. | | | | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | |
| 601 | 5 | 15 | 7 | 16 | 20 | 21 | 22 | 21 | 11 | 2 | 4 | 2 | 146 |
| 602 | ..... | 7 | 22 | 24 | 25 | 25 | 11 | 3 | ..... | ..... | ..... | ..... | 117 |
| 603 | 16 | 24 | 23 | 20 | 16 | 20 | ... | 17 | 13 | 23 | 4 | 20 | 196 |
| 604 | ..... | ..... | ..... | 1 | 24 | 22 | 20 | 20 | 19 | 9 | 17 | 5 | 137 |
| 605 | ..... | 7 | 12 | 19 | 10 | 25 | † | ..... | ..... | ..... | ..... | ..... | 73 |
| 606 | 1 | 18 | 2 | 7 | 18 | 8 | 14 | 1 | 6 | ..... | 1 | ..... | 76 |
| 607 | 2 | 4 | 9 | 9 | 23 | 23 | 23 | 16 | 15 | 17 | 20 | 9 | 170 |
| 608 | ..... | ..... | ..... | 2 | 27 | 28 | 24 | 27 | 24 | 26 | 22 | 15 | 195 |
| 609 | 13 | 17 | 20 | 21 | 21 | 20 | 6 | 19 | 16 | 20 | 20 | 7 | 200 |
| 610 | ..... | 5 | 12 | 10 | 9 | 8 | 2 | * | ..... | ..... | ..... | ..... | 46 |
| 611 | ..... | ..... | 13 | 21 | 26 | 17 | 21 | 18 | 19 | 18 | 14 | 18 | 185 |
| 612 | 11 | 15 | 22 | 18 | 19 | 22 | 23 | 21 | 10 | 21 | 18 | 9 | 209 |
| 613 | 6 | 20 | 23 | 18 | 15 | 19 | 12 | ..... | ..... | 1 | ..... | 1 | 115 |
| 614 | ..... | 6 | 16 | ..... | 7 | ..... | 1 | * | ..... | ..... | ..... | ..... | 30 |
| 615 | ..... | .. | ..... | 13 | 13 | 23 | 7 | ..... | ..... | ..... | ..... | ..... | 56 |
| 616 | ..... | 11 | 18 | 4 | 5 | 24 | 20 | 21 | 13 | 12 | 8 | ..... | 136 |
| 617 | 1 | 19 | 22 | 22 | 23 | 23 | 23 | 18 | 17 | 24 | 21 | 21 | 234 |
| 618 | 16 | 19 | 20 | 15 | 8 | 16 | 20 | 17 | 16 | 15 | 21 | 8 | 191 |
| 619 | 15 | 12 | 9 | 21 | 13 | 26 | 24 | 21 | 13 | 12 | 17 | 13 | 199 |
| 620 | 1 | 4 | 18 | 7 | 9 | 16 | 15 | 10 | 20 | 12 | 13 | 13 | 138 |
| 621 | ..... | 16 | 23 | 18 | 20 | 24 | 19 | 18 | 20 | 17 | 15 | ..... | 190 |
| 622 | ..... | ..... | 15 | 4 | 16 | 13 | 12 | 15 | 10 | 8 | 6 | ..... | 99 |
| 623 | 10 | 14 | 22 | 11 | 12 | 23 | 24 | 22 | 24 | 7 | 9 | 5 | 183 |
| 624 | 4 | 18 | 16 | 16 | 17 | 20 | 14 | 9 | 10 | 8 | 13 | .. .. | 145 |
| 625 | ..... | 2 | 21 | 19 | 22 | 19 | 23 | 22 | 15 | 15 | 19 | 1 | 178 |
| 626 | ..... | 6 | 1 | 13 | 17 | 15 | 15 | 11 | 11 | 9 | ..... | 4 | 107 |
| 627 | ..... | ..... | 10 | 19 | 7 | 3 | 2 | 6 | 6 | 3 | 5 | ..... | 61 |
| 628 | ..... | ..... | ..... | 5 | 19 | 16 | 19 | 22 | 20 | 19 | 12 | ..... | 132 |
| 629 | 1 | 22 | 18 | 1 | 19 | 13 | ..... | * | ..... | ..... | ..... | ..... | 74 |
| 630 | 18 | 24 | 24 | 21 | 24 | 13 | 17 | 16 | 17 | 15 | 6 | 18 | 213 |
| 631 | 5 | 25 | 12 | 19 | 21 | 19 | 9 | 13 | 13 | 9 | 19 | 1 | 165 |
| 632 | ..... | 3 | 22 | 15 | 19 | 22 | 20 | 20 | 16 | 8 | 21 | 19 | 185 |
| 633 | ..... | 16 | 15 | 12 | 11 | 23 | 16 | 11 | 18 | 15 | 8 | .... | 145 |
| 634 | ..... | ..... | 7 | 7 | 18 | 11 | 16 | 10 | 10 | 7 | 8 | 4 | 92 |
| 635 | 9 | 24 | 24 | 22 | 20 | 22 | 12 | 11 | 13 | 16 | 15 | 2 | 190 |
| 636 | ..... | ..... | 8 | 17 | 19 | 16 | 12 | ..... | 17 | 2 | * | ..... | 91 |
| 637 | ..... | ... . | ..... | 2 | 14 | 1 | * | ..... | ..... | ..... | ..... | ..... | 17 |
| 638 | ..... | ..... | 15 | 10 | 17 | 16 | 13 | 11 | 7 | 5 | 6 | ..... | 100 |
| 639 | ..... | ..... | 19 | 12 | 20 | 9 | * | ..... | ..... | ..... | ..... | ..... | 60 |
| 640 | ..... | 21 | 17 | 15 | 15 | 12 | 18 | 12 | 8 | ..... | 11 | ..... | 129 |
| 641 | ..... | ..... | ..... | 5 | 22 | 25 | 21 | 21 | 17 | 17 | 15 | 12 | 155 |
| 642 | 7 | 23 | 21 | 15 | 12 | 20 | 17 | 20 | 9 | 17 | 11 | 7 | 169 |
| 643 | ..... | 9 | 14 | 19 | 16 | 13 | 17 | 11 | 8 | 15 | 9 | ..... | 131 |
| 644 | ..... | ..... | 13 | 15 | 8 | 18 | 11 | 7 | 2 | ... | ..... | ..... | 74 |
| 645 | ..... | 14 | 18 | 22 | 21 | 22 | 16 | 25 | 22 | 13 | 8 | ..... | 181 |
| 646 | 9 | 16 | 4 | 20 | 22 | 20 | 14 | 19 | 9 | 14 | 15 | 4 | 166 |
| 647 | 1 | ..... | 5 | 9 | 5 | 18 | 23 | 23 | 19 | 19 | 15 | 9 | 146 |
| 648 | 15 | 18 | 19 | 15 | 19 | 16 | 5 | 18 | 13 | 17 | 17 | 7 | 182 |
| 649 | .... | 22 | 19 | 6 | 20 | 24 | 22 | 21 | 14 | 17 | 8 | 17 | 190 |
| 650 | ..... | .. ... | 20 | 14 | 23 | 22 | 20 | 17 | 18 | 2 | 3 | ..... | 139 |
| 651 | .. . | 15 | 9 | 10 | 18 | 24 | 19 | 13 | 18 | 18 | 22 | 4 | 170 |
| 652 | ..... | ..... | 4 | 1 | 17 | 21 | 19 | 9 | 16 | 7 | 16 | ..... | 110 |
| 653 | ..... | 14 | 17 | 15 | 24 | 22 | 10 | 21 | 13 | 12 | * | ..... | 148 |
| 654 | ..... | 10 | 18 | 16 | 17 | 25 | 20 | 24 | 24 | 20 | 15 | ..... | 189 |
| 655 | 17 | 22 | 21 | 11 | 13 | 7 | ..... | ..... | ..... | ... | ..... | ..... | 91 |
| 656 | ..... | ..... | 1 | 2 | 24 | 19 | 14 | 10 | 17 | ..... | 6 | 2 | 95 |
| 657 | ..... | 15 | 19 | 9 | 4 | 14 | 21 | 22 | 18 | 18 | 19 | 18 | 177 |
| 658 | ..... | ..... | 5 | 17 | 20 | 20 | 14 | 17 | 18 | 16 | 15 | 2 | 144 |
| 659 | 7 | 19 | 20 | 16 | 18 | 19 | 22 | 17 | 14 | 4 | 2 | ..... | 160 |
| 660 | ..... | ..... | 16 | 20 | 21 | 11 | 15 | 11 | 9 | 13 | 13 | 8 | 137 |

* Dead. † Stolen.

EGG RECORDS—CONTINUED.

BARRED PLYMOUTH ROCKS.

| Number of hen. | 1900. | | 1901. | | | | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | |
| 661 | ..... | ..... | 10 | 15 | 20 | 11 | 17 | 11 | 7 | 10 | 12 | 10 | 123 |
| 662 | ..... | ... . | 1 | 16 | 20 | 20 | 22 | 5 | ..... | 1 | * | ..... | 85 |
| 663 | 17 | 19 | 20 | 16 | 8 | 13 | 9 | 10 | 16 | 17 | 10 | ..... | 155 |
| 664 | 5 | 21 | 5 | 12 | 9 | 24 | 20 | 21 | 20 | 16 | 18 | ..... | 175 |
| 665 | 21 | 20 | 10 | 18 | 16 | 15 | 13 | 9 | 15 | 9 | 17 | 11 | 174 |
| 666 | .. .. | ..... | ..... | 20 | 8 | 17 | 13 | 14 | 13 | 14 | 13 | 3 | 115 |
| 667 | ..... | ..... | 3 | 16 | 17 | 3 | * | ..... | ..... | .... . | ..... | ..... | 39 |
| 668 | ..... | 2 | 1 | 15 | 20 | 13 | 13 | 16 | 13 | 1 | ..... | 1 | 94 |
| 669 | ..... | 3 | 19 | 20 | 26 | 23 | 19 | 18 | 14 | 19 | 17 | 1 | 179 |
| 670 | ..... | 6 | 13 | 5 | 22 | 12 | 20 | 21 | 24 | 19 | 21 | 4 | 167 |
| 671 | 5 | 20 | 6 | 22 | 18 | 21 | 16 | 16 | 18 | 15 | 10 | ... | 167 |
| 672 | 3 | 22 | 20 | 18 | 23 | 21 | 13 | 16 | 16 | 16 | 12 | 20 | 200 |
| 673 | ..... | 13 | 3 | 9 | 7 | 14 | 16 | 9 | 19 | 15 | ..... | ..... | 105 |
| 674 | ..... | ..... | 16 | 18 | 22 | 14 | 14 | 16 | 16 | 15 | 5 | 18 | 154 |
| 675 | ..... | ..... | 3 | 6 | 8 | ..... | 6 | ..... | ..... | ..... | ..... | ..... | 23 |
| 676 | 8 | 13 | 27 | 21 | 25 | 24 | 16 | 14 | 17 | 13 | 21 | 10 | 209 |
| 677 | ..... | ..... | 9 | 15 | 14 | 8 | ..... | .. .. | 8 | ..... | ..... | ..... | 54 |
| 678 | 4 | 1 | .... | 17 | 19 | 14 | 23 | 17 | 14 | 9 | 11 | ..... | 129 |
| 679 | ..... | ..... | 8 | 17 | 23 | 14 | 1 | ..... | 7 | ..... | ..... | ..... | 70 |
| 680 | 1 | 10 | 13 | 17 | 21 | 26 | 22 | 23 | 14 | 8 | 3 | ... | 157 |
| 681 | ..... | 9 | 13 | 16 | 19 | 21 | 14 | 15 | 15 | 12 | 11 | 4 | 149 |
| 682 | .. .. | ..... | 9 | 5 | 11 | 8 | 1 | * | .... | .... | ..... | ..... | 34 |
| 683 | 1 | 17 | 20 | 19 | 22 | 26 | 12 | * | ..... | ..... | ..... | ..... | 117 |
| 684 | ..... | ..... | 3 | 2 | 23 | 21 | 23 | 22 | 25 | 23 | 22 | 6 | 170 |
| 685 | 9 | ..... | 23 | 15 | 15 | 20 | 14 | 10 | 11 | 8 | 12 | 2 | 139 |
| 686 | ..... | .... | .... | 5 | 1 | ..... | 8 | 11 | 2 | 10 | ..... | 14 | 51 |
| 687 | ..... | ..... | 4 | 19 | 9 | 17 | 15 | * | ..... | ..... | ..... | ..... | 64 |
| 688 | ..... | ..... | 2 | 21 | 16 | 12 | 10 | 9 | 8 | 7 | 2 | ..... | 87 |
| 689 | ..... | ..... | 10 | 22 | 27 | 25 | 24 | 22 | 20 | 19 | 12 | ..... | 181 |
| 690 | ..... | ..... | 11 | 14 | 20 | 19 | 17 | 10 | 13 | 16 | 2 | 15 | 137 |
| 691 | ..... | ..... | 9 | 21 | 20 | 21 | 14 | 19 | 16 | 21 | 16 | 20 | 177 |
| 692 | ..... | ..... | 6 | 20 | 22 | 20 | 10 | 8 | 14 | 13 | 10 | 18 | 141 |
| 693 | ... .. | ..... | .... | 16 | 11 | 19 | 1 | ..... | ..... | ..... | ..... | ..... | 47 |
| 694 | ..... | ..... | 8 | 12 | 6 | 3 | 3 | 9 | * | .... | ..... | ..... | 40 |
| 695 | ..... | ..... | 19 | 11 | 12 | 24 | 22 | 16 | 16 | 15 | 2 | ..... | 137 |
| 696 | ..... | ..... | 14 | 22 | 20 | 22 | 30 | 23 | 22 | 27 | 9 | * | 189 |
| 697 | .. .. | ..... | 16 | 8 | 6 | 15 | 16 | 8 | ..... | 3 | ..... | ..... | 72 |
| 698 | .. ... | ..... | 23 | 24 | 24 | 15 | 20 | 19 | 17 | 21 | 21 | 8 | 192 |
| 699 | ... .. | ..... | 5 | 9 | 6 | 16 | 14 | 20 | 18 | 9 | 12 | 1 | 110 |
| 700 | ..... | .... | 8 | 21 | 26 | 19 | 14 | 14 | .... . | 18 | 5 | 7 | 132 |
| **WHITE WYANDOTTES.** | | | | | | | | | | | | | |
| 701 | 12 | 21 | 17 | ..... | 7 | 7 | 3 | * | . ... | ..... | ..... | ... .. | 67 |
| 702 | .... | 10 | 15 | 16 | 19 | 20 | 21 | 12 | 14 | 14 | 12 | 3 | 156 |
| 703 | ..... | ..... | 17 | 15 | 4 | 21 | 19 | 17 | 10 | .... | ..... | ..... | 103 |
| 704 | 10 | 21 | 17 | 14 | 12 | 12 | 7 | 13 | 12 | 10 | ..... | ..... | 128 |
| 705 | 12 | 4 | 19 | 17 | 18 | 15 | 14 | 11 | 13 | ..... | 14 | 5 | 142 |
| 706 | 15 | 15 | 3 | 18 | 16 | 21 | 22 | 15 | 15 | 20 | 18 | 3 | 181 |
| 707 | 12 | 11 | 23 | 11 | 11 | 19 | 17 | 14 | 15 | 12 | 12 | 2 | 159 |
| 708 | ... | ..... | 14 | 4 | 13 | 8 | 9 | 12 | 7 | 14 | .. . | ..... | 81 |
| 709 | ..... | 18 | 19 | 19 | 21 | 12 | 16 | 12 | 15 | 12 | 15 | 8 | 167 |
| 710 | 5 | 2 | 22 | 20 | 8 | 22 | 12 | 12 | 12 | 16 | 7 | ..... | 138 |
| 711 | ..... | 20 | 19 | 1 | 15 | 10 | 6 | ..... | ..... | ..... | 1 | ..... | 72 |
| 712 | .... | ..... | 18 | 19 | 17 | 19 | 18 | 11 | 11 | 10 | 7 | 1 | 131 |
| 713 | 10 | 15 | 18 | 11 | 13 | 14 | 14 | 13 | 10 | 12 | 13 | 1 | 144 |
| 714 | ..... | 3 | 22 | 17 | 15 | 14 | 15 | 13 | ..... | 11 | 7 | 7 | 124 |
| 715 | ..... | ..... | 17 | 15 | 10 | 14 | 13 | 12 | 8 | 11 | 9 | 12 | 121 |
| 716 | ..... | ..... | 15 | 15 | 14 | 20 | 19 | 20 | 13 | 11 | 5 | ..... | 132 |
| 717 | 13 | 15 | 18 | 12 | 15 | 9 | 17 | 8 | 12 | 6 | 12 | 7 | 144 |

* Dead.

EGG RECORDS—CONTINUED.

WHITE WYANDOTTES.

| Number of hen. | 1900. | | 1901. | | | | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | |
| 718... | 4 | 21 | 9 | 18 | 15 | 11 | 13 | 14 | 15 | 12 | 11 | 11 | 154 |
| 719... | ..... | ..... | 16 | 4 | 6 | .... | ..... | ..... | 2 | 8 | 6 | 10 | 52 |
| 720... | 18 | 5 | 23 | 17 | 20 | 13 | 1 | 11 | 5 | ..... | ..... | ..... | 113 |
| 721... | 7 | 21 | 23 | 18 | 13 | 17 | 9 | ..... | ..... | ..... | ..... | ..... | 108 |
| 722... | ..... | 7 | 18 | 16 | 16 | 13 | 5 | ..... | . ... | 1 | * | ..... | 76 |
| 723... | ..... | 4 | 20 | 21 | 21 | 15 | 16 | 18 | 12 | 12 | 22 | ..... | 161 |
| 724... | 18 | 20 | 19 | 18 | 16 | 20 | 10 | 19 | 15 | 16 | 9 | 15 | 195 |
| 725... | 9 | 5 | 17 | 10 | 3 | 3 | * | ..... | ..... | ..... | ..... | ..... | 47 |
| 726... | ... . | 14 | 14 | 4 | 8 | 5 | 14 | 2 | 3 | ..... | ..... | .... | 64 |
| 727... | 7 | 14 | 14 | 15 | 13 | 15 | 10 | 14 | 7 | 6 | 1 | 8 | 124 |
| 728... | 1 | 17 | 19 | 16 | 18 | 21 | 24 | 17 | 16 | * | ..... | ..... | 149 |
| 729... | 5 | 16 | 20 | 20 | 20 | 24 | 7 | 20 | 9 | 25 | 22 | 15 | 203 |
| 730... | 9 | 8 | 21 | 15 | 14 | 4 | ..... | 7 | 8 | ..... | 14 | 7 | 107 |
| 731... | ..... | ..... | 16 | 14 | 4 | * | ... .. | ..... | ..... | ..... | ..... | ..... | 34 |
| 732... | 4 | ..... | 13 | 14 | 12 | 8 | 5 | 11 | 13 | ..... | ..... | ..... | 86 |
| 733... | 14 | 18 | 19 | 13 | 1 | ..... | 1 | * | ..... | ..... | ..... | ..... | 66 |
| 734... | 12 | 20 | 21 | 15 | 12 | 8 | * | ..... | ..... | ..... | ..... | ..... | 88 |
| 735... | ..... | 2 | 20 | 21 | 26 | 21 | 14 | 14 | 15 | 14 | 11 | 18 | 176 |
| 736... | 7 | 20 | 22 | 15 | 8 | 7 | * | ..... | ..... | ..... | ..... | .... | 79 |
| 737... | ..... | 13 | 2 | 8 | 15 | * | ..... | ..... | ..... | ..... | .. | ..... | 38 |
| 738... | 3 | 3 | 12 | 19 | 24 | 19 | 16 | 16 | 6 | 16 | 9 | 20 | 163 |
| 739... | ..... | 6 | 11 | 17 | 3 | 18 | 19 | 2 | 18 | 18 | 10 | 17 | 139 |
| 740... | 1 | 7 | 10 | 3 | 1 | * | ..... | ..... | ..... | ..... | ..... | ..... | 22 |
| 741... | ..... | 3 | 22 | 8 | 13 | 17 | 13 | 10 | . 13 | 18 | 12 | 7 | 136 |
| 742... | 2 | 21 | 21 | 17 | 18 | 19 | 23 | 22 | 21 | 20 | 12 | ..... | 208 |
| 743... | 10 | 14 | 13 | 7 | 13 | 12 | 10 | 8 | 7 | 9 | 7 | 12 | 119 |
| 744... | 23 | 4 | 21 | 21 | 10 | 19 | 16 | 10 | 16 | 18 | 13 | 2 | 173 |
| 745... | ..... | 3 | 17 | 15 | 19 | 21 | 21 | 19 | 19 | 18 | 7 | ..... | 159 |
| 746... | ..... | ..... | 9 | 4 | 18 | 11 | 9 | * | ..... | ..... | ..... | ..... | 51 |
| 747... | 6 | 18 | 19 | 14 | 14 | 17 | 22 | 18 | 21 | 12 | 15 | 10 | 186 |
| 748... | ..... | ..... | 11 | 16 | 19 | 13 | 7 | 5 | 8 | 6 | 6 | 9 | 90 |
| 749... | 7 | 19 | 23 | 19 | 20 | 23 | 22 | 8 | 15 | 9 | * | ..... | 165 |
| 750... | ..... | . .... | 19 | 15 | 13 | 10 | * | ..... | ..... | .. ... | ..... | ..... | 57 |
| 751... | 5 | 5 | 18 | 17 | 18 | 18 | 19 | 14 | 18 | 8 | 16 | 10 | 166 |
| 752... | 8 | 13 | 20 | 14 | 13 | 12 | 7 | ..... | ..... | ..... | ..... | ..... | 87 |
| 753... | 20 | 13 | 22 | 21 | 19 | 21 | 13 | 20 | 14 | 22 | 9 | 23 | 217 |
| 754... | 10 | 5 | 16 | 7 | 13 | 9 | 10 | 8 | 12 | 9 | ..... | ..... | 99 |
| 755... | 9 | 9 | 11 | 13 | 11 | 7 | 2 | ..... | ..... | ..... | ..... | ..... | 62 |
| 756... | .... | .... | 15 | 12 | 12 | 18 | 13 | 13 | 14 | 15 | 10 | 12 | 134 |
| 757... | ..... | ..... | 20 | 16 | 19 | 19 | 1 | 10 | 20 | 13 | 13 | 10 | 141 |
| 758... | ..... | ..... | 10 | 1 | 13 | 1 | ..... | 9 | 1 | 12 | ..... | 7 | 54 |
| 759... | 9 | 7 | 16 | 1 | ..... | 3 | . ... | ..... | ..... | .. ... | ..... | ..... | 36 |
| 760... | 17 | 17 | 14 | 9 | 8 | 20 | 14 | 10 | 1 | ..... | 9 | ... . | 119 |
| 761... | ..... | 15 | 11 | 6 | 14 | 12 | 11 | 12 | 14 | 10 | 13 | ..... | 118 |
| 762... | 19 | 5 | 21 | 2 | 10 | 19 | 21 | 24 | 18 | 20 | 19 | 8 | 186 |
| 763... | 9 | 3 | 18 | 17 | 18 | 20 | 19 | 18 | 12 | ..... | 6 | 19 | 159 |
| 764... | .... . | 3 | 18 | 6 | 20 | 15 | 15 | 13 | ..... | . .... | ..... | ..... | 90 |
| 765... | 16 | 22 | 18 | 4 | 15 | 21 | 23 | 23 | 22 | 23 | 19 | 20 | 226 |
| 766... | 13 | 14 | 17 | 8 | 7 | 17 | 19 | 16 | 12 | 21 | 19 | 10 | 173 |
| 767... | 16 | 23 | 16 | 11 | 9 | 3 | ..... | ..... | ..... | ..... | .. .. | ..... | 78 |
| 768... | 4 | 2 | 18 | 12 | 11 | 10 | 12 | 16 | 10 | 12 | 8 | 4 | 119 |
| 769... | 10 | 15 | 10 | 6 | 8 | 18 | 13 | 14 | 13 | 15 | 12 | 12 | 146 |
| 770... | 18 | 21 | 23 | 19 | 17 | 19 | 17 | 15 | 16 | 8 | 15 | 19 | 207 |
| 771... | .. . | 13 | 19 | 3 | 11 | 11 | 8 | .... | ..... | ..... | ..... | ..... | 65 |
| 772... | 10 | 19 | 11 | 19 | 16 | 19 | 14 | 10 | 11 | 10 | 14 | 8 | 161 |
| 773... | 13 | ..... | 14 | 13 | 12 | 18 | 5 | 4 | 3 | * | ..... | ..... | 82 |
| 774... | 12 | .... | 6 | 16 | 18 | 19 | 10 | * | .. .. | ..... | ..... | ..... | 81 |
| 775.. | 16 | 20 | 22 | 13 | 23 | 17 | 8 | 8 | 7 | * | ..... | ..... | 134 |
| 776... | 18 | 3 | 17 | 9 | 12 | 15 | 13 | 14 | 14 | 13 | 12 | ..... | 140 |
| 777... | 18 | 22 | 22 | 20 | 16 | 21 | 22 | 16 | 16 | 23 | 21 | 16 | 233 |

*Dead.

EGG RECORDS—CONCLUDED.

WHITE WYANDOTTES.

| Number of hen. | 1900. | | 1901. | | | | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | |
| 778... | 4 | 11 | 20 | 10 | 4 | 20 | 10 | 18 | 15 | 17 | 21 | 13 | 163 |
| 779... | 15 | 8 | 22 | 15 | 10 | 16 | 20 | 23 | 11 | 18 | 16 | 9 | 183 |
| 780... | 17 | 15 | 15 | 14 | 14 | 13 | 13 | 8 | 15 | 16 | 17 | 9 | 166 |
| 781... | 11 | 14 | 10 | 19 | 2 | 14 | 2 | 6 | 5 | 3 | 1 | ..... | 87 |
| 782... | 7 | 13 | 21 | 20 | 18 | 12 | 18 | 15 | 12 | 15 | 2 | ... . | 153 |
| 783... | 12 | 19 | 10 | 13 | 14 | 11 | 16 | 12 | 16 | 15 | 12 | 11 | 161 |
| 784... | ..... | 8 | 14 | 20 | 14 | 4 | ..... | ..... | ..... | ..... | ... .. | ..... | 60 |
| 785... | 15 | 16 | 12 | 2 | 12 | 16 | 7 | ..... | ..... | ..... | ..... | ..... | 80 |
| 786... | 22 | 19 | 14 | 13 | 5 | 12 | 11 | 12 | 4 | 13 | 11 | 14 | 150 |
| 787... | ..... | 17 | 21 | 21 | 17 | 23 | 13 | * | ..... | ..... | ..... | ..... | 112 |
| 788... | 10 | 11 | 13 | 14 | 9 | 7 | 17 | 12 | 15 | 11 | 9 | ..... | 128 |
| 789. . | ..... | 13 | 16 | 3 | 13 | 25 | 17 | 19 | 11 | 11 | 19 | 18 | 165 |
| 790... | ..... | 12 | 19 | 15 | 4 | 14 | 10 | 10 | 1 | * | ..... | ..... | 85 |

* Dead.

## CONCLUSION.

This report does not deal with results, for sufficient time has not yet elapsed since beginning the test to breed birds and test their laying qualities.

During the three years in which we have been selecting breeding stock by use of the trap nests we have found 30 hens that laid between 200 and 251 eggs each in a year. Twenty-six of them are now in our breeding pens and constitute —until other additions are made to them—the "foundation stock" upon which our breeding operations are based. Males for our use have been raised from them during the last two years. The number of the foundation stock, now secured, makes practicable the avoidance of inbreeding, and this is to be strictly guarded against, as it is doubtful if the inbred hen has sufficient constitution to enable her to stand the demands of heavy egg production.

All of the other breeding stock we are now carrying are tested hens that have laid over 180 eggs in a year; pullets whose mothers laid over 200 eggs in one year and whose fathers' mothers laid over 200 eggs in a year; and pullets sired by cockerels whose mothers and grandmothers laid over 200 eggs in one year. The size and color of the Plymouth Rock eggs are very fine. The eggs from the Wyandottes are of good shape and size, but as yet too light in color.

# FEEDING STUFF INSPECTION.

CHAS. D. WOODS, Director.

J. M. BARTLETT, chemist in charge of inspection analyses.

## CHIEF REQUIREMENTS OF THE LAW.

The points of the law of most interest to dealer and consumer are:

*Kinds of Feed coming within the Law.* The law applies to *all feeding stuffs except* hays and straws; whole seeds and meals of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn; wheat, buckwheat and rye brans or middlings *not mixed with other substances,* but sold separately, as distinct articles of commerce.

*Inspection tax and tag.* To meet the expenses of inspection, a tax of ten cents per ton must be paid to the Director of the Maine Agricultural Experiment Station, who is required to furnish a tag stating that all charges have been paid. This tag, which bears the Director's signature, shows that the tax has been paid but is *not a guarantee of the quality of the goods.*

*The brand.* Each package of feeding stuff included within the law shall have affixed the inspection tax tag and shall also bear, conspicuously printed: the number of net pounds contained in the package, the name or trade mark under which it is sold, the name of the manufacturer or shipper, the place of manufacture, the place of business of manufacturer or shipper, the percentage of crude protein, the percentage of crude fat. These statements may be printed directly on the bag, on a tag attached to the package, or on the back of the inspection tax tag furnished by the Director of the Station. The quality of the goods is guaranteed by the manufacturer, importer or dealer, *and not by the Station.* The samples collected and analyzed by the Station show whether the goods are up to guarantee or not.

In the pages which follow there are given the results of the analyses of samples sent in by correspondents and collected by the Station inspector in the fall and early winter of 1901-02. The results of the analyses are discussed on pages 54 and beyond.

MANUFACTURERS AND PLACE OF SAMPLING.

| Station number. | Manufacturer or Jobber. | Manufactured at | Sampled at |
|---|---|---|---|
| 9375 | R. W. Biggs & Co | Memphis, Tenn | Bangor |
| 9376 | R. W. Biggs & Co | Memphis, Tenn | South Paris |
| 9377 | R. W. Biggs & Co | Memphis, Tenn | Cornish |
| 9365 | R. W. Biggs & Co | Memphis, Tenn | Cumberland |
| 9378 | F. W. Brodé & Co | Memphis, Tenn | Camden |
| 9379 | F. W. Brodé & Co | Memphis, Tenn | Winterport |
| 9380 | F. W. Brodé & Co | Memphis, Tenn | Belfast |
| 9381 | F. W. Brodé & Co | Memphis, Tenn | Portland |
| 9382 | F. W. Brodé & Co | Memphis, Tenn | Brunswick |
| 9383 | F. W. Brodé & Co | Memphis, Tenn | Bath |
| 9384 | F. W. Brodé & Co | Memphis, Tenn | Portland |
| 9385 | Chapin & Co | St. Louis, Mo | Stroudwater |
| 9330 | Doten Grain Co | | Dixfield |
| 9328 | Doten Grain Co | | Portland |
| 9304 | Humphreys, Goodwin & Co | Memphis, Tenn | Newport |
| 9386 | Humphreys, Goodwin & Co | Memphis, Tenn | Richmond |
| 9387 | Humphreys, Goodwin & Co | Memphis, Tenn | Brunswick |
| 9458 | Humphreys, Goodwin & Co | Memphis, Tenn | Mt. Vernon |
| 9388 | Hunter Brothers | St. Louis, Mo | Bangor |
| 9389 | Hunter Brothers | St. Louis, Mo | Lewiston |
| 9390 | Hunter Brothers | St. Louis, Mo | Dexter |
| 9391 | Hunter Brothers | St. Louis, Mo | Corinna |
| 9392 | Hunter Brothers | St. Louis, Mo | Hiram |
| 9393 | J. E. Soper & Co | Boston | Bangor |
| 9394 | J. E. Soper & Co | Boston, Mass | Bangor |
| 9395 | J. E. Soper & Co | Boston, Mass | Norway |
| 9396 | J. E. Soper & Co | Boston, Mass | Augusta |
| 9397 | J. E. Soper & Co | Boston, Mass | Portland |
| 9559 | J. E. Soper & Co | Boston | Macwahoc |
| 9367 | The American Cotton Oil Co | Brinkley, Ark | Macwahoc |
| 9368 | The American Cotton Oil Co | Brinkley, Ark | Corinna |
| 9369 | The American Cotton Oil Co | Little Rock, Ark | Norway |
| 9370 | The American Cotton Oil Co | Little Rock, Ark | Yarmouth |
| 9371 | The American Cotton Oil Co | Little Rock, Ark | Freeport |
| 9329 | The American Cotton Oil Co | Pine Bluff, Ark | Dixfield |
| 9305 | The American Cotton Oil Co | St. Louis, Mo | Newport |
| 9324 | The American Cotton Oil Co | St. Louis, Mo | Detroit |
| 9306 | The American Cotton Oil Co | Jackson, Tenn | Newport |
| 9372 | The American Cotton Oil Co | Jackson, Tenn | Old Town |
| 9373 | The American Cotton Oil Co | Memphis, Tenn | Auburn |
| 9374 | The American Cotton Oil Co | Memphis, Tenn | Rockland |
| 9301 | The American Cotton Oil Co | | Howes Corner |
| 9302 | | | Howes Corner |
| 9307 | | | Newport |
| 9321 | | | South Dover |
| 9322 | L. N. Littlehale | | Rockland |
| 9366 | Noyes & Pearson | | West Falmouth |
| 9398 | B. F. Parrott | | Augusta |
| 9399 | E. D. Walker | | Brownfield |
| 9400 | Warren Bruce | | Augusta |
| 9401 | W. B. & E. P. Kendall | | Bowdoinham |

ANALYSES OF SAMPLES.

| Name of Feed. | Protein. | | Fat. | | Station number. |
|---|---|---|---|---|---|
| | Found — per cent. | Guaranteed — per cent. | Found — per cent. | Guaranteed — per cent. | |
| "Canary" Brand Cotton Seed Meal. ... | 47.06 | 43.00 | 9.21 | 9.00 | 9375 |
| "Canary" Brand Cotton Seed Meal..... | 46.31 | 43.00 | 9.26 | 9.00 | 9376 |
| "Canary" Brand Cotton Seed Meal. .. | 46.50 | 43.00 | 10.27 | 9.00 | 9377 |
| "Canary" Brand Cotton Seed Meal..... | 46.25 | 43.00 | 12.58 | 9.00 | 9365 |
| Owl Brand Pure Cotton Seed Meal .... | 47.31 | 43.00 | 9.76 | 9.00 | 9378 |
| Owl Brand Pure Cotton Seed Meal ..... | 47.44 | 43.00 | 8.79 | 9.00 | 9379 |
| Owl Brand Pure Cotton Seed Meal . .. | 44.38 | 43.00 | 10.37 | 9.00 | 9380 |
| Owl Brand Pure Cotton Seed Meal .... | 47.75 | 43.00 | 8.79 | 9.00 | 9381 |
| Owl Brand Pure Cotton Seed Meal ..... | 43.06 | 43.00 | 10.39 | 9 00 | 9382 |
| Owl Brand Pure Cotton Seed Meal . ... | 45.25 | 43.00 | 8.09 | 9.00 | 9383 |
| Cotton Seed Meal ..... | 46.13 | ..... .... | 8.37 | ..... | 9384 |
| Cotton Seed Meal ... ..... ... .. .... | 45.63 | 43.00 | 8.04 | 9.00 | 9385 |
| "Star Brand" Cotton Seed Meal ... ... | 47 13 | 43.00 | 10.26 | 9.00 | 9330 |
| Cotton Seed Meal ..... ..... | 47.50 | 43.00 | 9.15 | 9.00 | 9328 |
| "Dixie" Brand Cotton Seed Meal..... | 43.88 | 43.00 | 9.83 | 9.00 | 9304 |
| "Dixie" Brand Cotton Seed Meal ..... | 44.00 | 43.00 | 10.27 | 9.00 | 9386 |
| "Dixie" Brand Cotton Seed Meal..... | 44.00 | 43.00 | 8.42 | 9.00 | 9387 |
| "Dixie" Brand Cotton Seed Meal..... | 45.65 | 43.00 | 10.39 | 9.00 | 9458 |
| Cotton Seed Meal ..... ..... | 45.88 | 43.00 | 9.78 | 9.00 | 9388 |
| Cotton Seed Meal ..... ..... ..... | 47.63 | 43.00 | 10.90 | 9.00 | 9389 |
| Cotton Seed Meal ..... ..... | 46.69 | 43.00 | 10.77 | 9.00 | 9390 |
| Cotton Seed Meal ..... ..... ..... | 49.31 | 43.00 | 8.13 | 9.00 | 9391 |
| Cotton Seed Meal ... ..... ..... | 44.88 | 43.00 | 10.42 | 9.00 | 9392 |
| Cotton Seed Meal ..... .. . .... | 47.63 | 43.00 | 8.44 | 9.00 | 9393 |
| Cotton Seed Meal ..... ..... | 42.88 | 43.00 | 8.53 | 9.00 | 9394 |
| Cotton Seed Meal ..... ..... | 48.63 | 43.00 | 10.30 | 9.00 | 9395 |
| Cotton Seed Meal ... ..... | 44.06 | 43.00 | 10.16 | 9.00 | 9396 |
| Cotton Seed Meal ..... ..... .... | 42.69 | 43.00 | 8.44 | 9.00 | 9397 |
| Cotton Seed Meal ..... ..... | 46.88 | 43.00 | 8.75 | 9.00 | 9559 |
| Prime Cotton Seed Meal ..... .... | 44.56 | 43.00 | 10.68 | 9.00 | 9367 |
| Prime Cotton Seed Meal ..... ..... | 45.13 | 43.00 | 10.47 | 9.00 | 9368 |
| Prime Cotton Seed Meal ..... ..... | 44.00 | 43.00 | 8.73 | 9.00 | 9369 |
| Prime Cotton Seed Meal ..... ... .... | 45.13 | 43.00 | 8.87 | 9.00 | 9370 |
| Prime Cotton Seed Meal ..... .. . ... | 44.25 | 43.00 | 9.03 | 9.00 | 9371 |
| Prime Cotton Seed Meal ..... | 46.00 | 43.00 | 10.44 | 9.00 | 9329 |
| Prime Cotton Seed Meal .... ..... | 45.38 | 43.00 | 10.37 | 9.00 | 9305 |
| Prime Cotton Seed Meal ... ..... | 46.25 | 43.00 | 9.90 | 9.00 | 9324 |
| Prime Cotton Seed Meal . ..... .. .. | 40.00 | 43.00 | 9.75 | 9.00 | 9306 |
| Prime Cotton Seed Meal ..... ..... | 43.25 | 43.00 | 9.66 | 9.00 | 9372 |
| Prime Cotton Seed Meal ..... | 44.63 | 43.00 | 9.81 | 9.00 | 9373 |
| Prime Cotton Seed Meal ..... ..... | 42.50 | 43.00 | 10.68 | 9.00 | 9374 |
| Prime Cotton Seed Meal ..... ... | 46.94 | 43.00 | 11.27 | 9.00 | 9301 |
| Cotton Seed Meal ..... .... ..... | 46.00 | ..... .. | 9.47 | .... ... | 9302 |
| Cotton Seed Meal ..... ..... .. | 44.75 | 43.00 | 8.45 | 9.00 | 9307 |
| Cotton Seed Meal ... ..... ... | 44.75 | ..... | 10.41 | ..... | 9321 |
| Cotton Seed Meal ..... | 46.25 | ..... .... | 9.86 | ..... | 9322 |
| Green Diamond Brand Cotton Seed M'l | 45.13 | 43.00 | 12.91 | 9.00 | 9366 |
| Green Diamond Brand Cotton Seed M'l | 46.88 | 43.00 | 8.19 | 9.00 | 9398 |
| Green Diamond Brand Cotton Seed M'l | 45.63 | 43.00 | 8.65 | 9.00 | 9399 |
| Star Brand Prime FinelyG'd Cot. S'd M'l | 47.25 | 43.00 | 10.11 | 9.00 | 9400 |
| Star Brand Prime FinelyG'd Cot. S'd M'l | 44.63 | 43.00 | 11.98 | 9 00 | 9401 |

## MANUFACTURERS AND PLACE OF SAMPLING.

| Station number. | Manufacturer or Jobber. | Manufactured at | Sampled at |
|---|---|---|---|
| 9402 | F. G. Gerry & Co | | Dexter |
| 9403 | Oscar Holway Co | | Auburn |
| 9403 | R. H. Soule | | South Windham |
| 9404 | C. A. Hooker | | Bath |
| 9344 | A. W. Gilman & Co | | Foxcroft |
| 9407 | A. W. Gilman & Co | | Foxcroft |
| 9406 | Ginn & Field Co | | Belfast |
| 9319 | S. A. & J. H. True Co | | Boothbay |
| 9405 | Saco Grain Co | | Saco |
| 9409 | Glucose Sugar Refining Co | | Biddeford |
| 9412 | Glucose Sugar Refining Co | | Bangor |
| 9414 | Glucose Sugar Refining Co | | Brownfield |
| 9415 | Glucose Sugar Refining Co | | Portland |
| 9416 | Glucose Sugar Refining Co | | Corinna |
| 9417 | Glucose Sugar Refining Co | | Auburn |
| 9418 | Glucose Sugar Refining Co | | Belfast |
| 9418 | Glucose Sugar Refining Co | | Dexter |
| 9419 | Charles Pope Glucose Co | | Lewiston |
| 9420 | Charles Pope Glucose Co | | Gardiner |
| 9421 | Charles Pope Glucose Co | | Saco |
| 9422 | Charles Pope Glucose Co | | Stroudwater |
| 9423 | Charles Pope Glucose Co | | Brunswick |
| 9424 | Charles Pope Glucose Co | | Portland |
| 9425 | Charles Pope Glucose Co | | South Brewer |
| 9426 | National Starch Co | Buffalo, N. Y. | Westbrook |
| 9427 | National Starch Co | Buffalo, N. Y. | Norway |
| 9428 | National Starch Co | Des Moines, Iowa | Richmond |
| 9429 | National Starch Co | Des Moines, Iowa | Lewiston |
| 9430 | National Starch Co | Des Moines, Iowa | Auburn |
| 9431 | National Starch Co | Indianapolis, Ind. | Richmond |
| 9432 | National Starch Co | Indianapolis, Ind. | South Windham |
| 9433 | National Starch Co | Indianapolis, Ind. | Corinna |
| 9434 | Glucose Sugar Refining Co | | Biddeford |
| 9435 | Glucose Sugar Refining Co | | West Falmouth |
| 9436 | Glucose Sugar Refining Co | | Waterville |
| 9437 | Glucose Sugar Refining Co | | Biddeford |
| 9438 | National Starch Co | | Norway |
| 9439 | Glucose Sugar Refining Co | | Biddeford |
| 9441 | Glucose Sugar Refining Co | | Belfast |
| 9440 | Glucose Sugar Refining Co | | Brunswick |
| 9442 | American Milling Co | Riverdale, Ill | Auburn |
| 9443 | J. W. Barwell | Waukegan, Ill | Corinna |
| 9444 | American Linseed Co | Chicago, Ill | Lewiston |
| 9445 | American Linseed Co | Chicago, Ill | Hallowell |
| 9446 | American Linseed Co | Chicago, Ill | Bangor |
| 9447 | Hunter Brothers | St. Louis, Mo. | Brunswick |
| 9448 | Hunter Brothers | St. Louis, Mo. | Portland |
| 9449 | Gordon & Henry | | Readfield |
| 9450 | Hunter, MacMaster Co | | Pittsfield |
| 9451 | American Agricul. Chem. Co | Boston, Mass | Hiram |
| 9452 | American Agricul. Chem. Co | Boston, Mass | Bangor |
| 9338 | The Bowker Co | Boston, Mass | Newport |

ANALYSES OF SAMPLES.

| Name of Feed. | Protein. Found—per cent. | Protein. Guaranteed—per cent. | Fat. Found—per cent. | Fat. Guaranteed—per cent. | Station number. |
|---|---|---|---|---|---|
| Cotton Seed Meal | 44.38 | | 7.75 | | 940[illegible] |
| Cotton Seed Meal | 43.00 | 43.00 | 9.54 | 9.00 | 9401 |
| Cotton Seed Meal | 46.75 | | 7.70 | | 9402 |
| Cotton Seed Meal | 46.06 | | 10.52 | | 9404 |
| Cotton Seed Meal | 46.94 | | 11.68 | | 9344 |
| Cotton Seed Meal | 47.44 | | 10.61 | | 9407 |
| Cotton Seed Meal | 46.13 | | 11.13 | | 9406 |
| Cotton Seed Meal | 43.06 | 41.00 | 9.60 | 9.00 | 9311 |
| Cotton Seed Meal | 46.44 | 41.00 | 8.31 | 9.00 | 9405 |
| Chicago Gluten Meal | 36.69 | 38.00 | 6.33 | 3.00 | 9409 |
| Chicago Gluten Meal | 37.25 | 38.00 | 4.85 | 3.00 | 9412 |
| Chicago Gluten Meal | 36.75 | 38.00 | 4.31 | 3.00 | 9414 |
| Chicago Gluten Meal | 35.81 | 38.00 | 4.73 | 3.00 | 9415 |
| Chicago Gluten Meal | 37.38 | 38.00 | 1.27 | 3.00 | 9416 |
| Chicago Gluten Meal | 33.69 | 38.00 | 2.72 | 3.00 | 9417 |
| Chicago Gluten Meal | 35.81 | 39.00 | 5.12 | 2.00 | 9413 |
| Chicago Gluten Meal | 37.38 | 39.00 | 1.30 | 2.00 | 9418 |
| Cream Gluten Meal | 36.88 | 34.12 | 4 41 | 3.20 | 9419 |
| Cream Gluten Meal | 40.69 | 34.12 | 5.30 | 3.20 | 9420 |
| Cream Gluten Meal | 40.63 | 34.12 | 5.51 | 3.20 | 9421 |
| Cream Gluten Meal | 37.06 | 34.12 | 3.87 | 3.20 | 9422 |
| Cream Gluten Meal | 34.69 | 34.12 | 4.14 | 3.20 | 9423 |
| Cream Gluten Meal | 33.88 | 34.12 | 4.89 | 3.20 | 9424 |
| Cream Gluten Meal | 41.44 | 34.12 | 1.14 | 3.20 | 9425 |
| King Gluten Meal | 36.94 | 36.00 | 2.57 | 3.2 | 9426 |
| King Gluten Meal | 33 75 | 36.00 | 3.62 | 3.2 | 9427 |
| King Gluten Meal | 37.69 | 32.4 | 2.25 | 3.7 | 9428 |
| King Gluten Meal | 37.63 | 39.00 | 4.27 | 3.5 | 9429 |
| King Gluten Meal | 34.00 | 32.4 | 2.81 | 3.7 | 9430 |
| King Gluten Meal | 31.63 | 36 00 | 3.04 | 4.3 | 9431 |
| King Gluten Meal | 38.00 | 35.6 | 3.99 | 4.28 | 9432 |
| King Gluten Meal | 34.50 | 35.6 | 3.00 | 4.28 | 9433 |
| Davenport Gluten Feed | 26.69 | 27.5 | 4.92 | 3.3 | 9434 |
| Davenport Gluten Feed | 25.25 | 27.5 | 4.92 | 3.3 | 9435 |
| Davenport Gluten Feed | 23.31 | 27.5 | 4.67 | 3.3 | 9436 |
| Buffalo Gluten Feed | 25.88 | 27.5 | 5.55 | 3.3 | 9437 |
| Queen Gluten Feed | 24.19 | 23.6 | 1.95 | 2.2 | 9438 |
| Germ Oil Meal | 22.13 | 25.5 | 10.41 | 10.5 | 9439 |
| Germ Oil Meal | 24.06 | 25.5 | 12.70 | 10.5 | 9441 |
| Germ Oil Meal | 22.94 | 25.3 | 10.30 | 3.00 | 9440 |
| Sucrene Oil Meal | 28.25 | 25.00 | 7.34 | 3.5 | 9442 |
| Blatchford's Calf Meal | 26.00 | 26.00 | 4.91 | 5.00 | 9443 |
| Cleveland Flax Meal | 39.88 | 37.5 | 1.57 | 1.00 | 9444 |
| Cleveland Flax Meal | 38.69 | 37.5 | 2.03 | 1.00 | 9445 |
| Cleveland Flax Meal | 40.50 | 37.5 | 2.21 | 1.00 | 9446 |
| Linseed Meal | 33.88 | 34.00 | 9.41 | 6.5 | 9447 |
| Linseed Meal | 34.19 | 34.00 | 9.13 | 6.5 | 9448 |
| Linseed Oil Meal | 38.06 | 38.00 | 2.70 | 1.00 | 9449 |
| Linseed Oil Meal | 36.56 | | 1.74 | | 9450 |
| Bradley's Superior Meat Meal | 47.69 | 40.00 | 9.50 | 8.00 | 9451 |
| Bradley's Superior Meat Meal | 52.63 | 40.00 | 8.88 | 8.00 | 9452 |
| Bowkers Animal Meal | 37.06 | 30.00 | 9.14 | 5.00 | 9338 |

MANUFACTURERS AND PLACE OF SAMPLING.

| Station number. | Manufacturer and Jobber. | Manufactured at | Sampled at |
|---|---|---|---|
| 9453 | The Bowker Co | Boston, Mass | Fryeburg |
| 9454 | The Bowker Co | Boston, Mass | Bangor |
| 9455 | Lowell Fertilizer Co | | Bangor |
| 9333 | E. J. Philbrick | Augusta, Maine | Augusta |
| 9456 | D. W. Romaine | New York City | West Falmouth |
| 9457 | Noyes & Pearson | | West Falmouth |
| 9364 | Kendall & Whitney | | Portland |
| 9459 | American Cereal Co | Chicago, Ill | Camden |
| 9461 | American Cereal Co | Chicago, Ill | Westbrook |
| 9462 | American Cereal Co | Chicago, Ill | Bath |
| 9460 | American Cereal Co | Chicago, Ill | Augusta |
| 9463 | American Cereal Co | Chicago, Ill | Brunswick |
| 9464 | American Cereal Co | Chicago, Ill | Bath |
| 9465 | American Cereal Co | Chicago, Ill | Richmond |
| 9466 | American Cereal Co | Chicago, Ill | Cornish |
| 9467 | American Cereal Co | Chicago, Ill | Westbrook |
| 9468 | American Cereal Co | Chicago, Ill | Westbrook |
| 9469 | Ellsworth & Co | Buffalo, N. Y | Portland |
| 9470 | Ellsworth & Co | Buffalo, N. Y | Bucksport |
| 9471 | Ellsworth & Co | Buffalo, N. Y | Hallowell |
| 9558 | Ellsworth & Co | Buffalo, N. Y | Hallowell |
| 9472 | Great Western Cereal Co | Muscatine, Iowa | Saco |
| 9473 | W. H. Haskell & Co | Toledo, Ohio | Cumberland |
| 9474 | H. R. Heath & Son | Fort Dodge, Iowa | Cornish |
| 9475 | H. R. Heath & Son | Fort Dodge, Iowa | Bangor |
| 9476 | H. R. Heath & Son | Fort Dodge, Iowa | Portland |
| 9477 | The H-O Co | Buffalo, N. Y | Westbrook |
| 9478 | The H-O Co | Buffalo, N. Y | Westbrook |
| 9479 | The H-O Co | Buffalo, N. Y | Westbrook |
| 9480 | The H-O Co | Buffalo, N. Y | Westbrook |
| 9481 | Norton, Chapman & Co | Boston, Mass | Bath |
| 9411 | | | Gore |
| 9303 | | | Howes Corner |
| 9482 | Kentucky Milling Co | Henderson, Ky | Fryeburg |
| 9484 | Kentucky Milling Co | Henderson, Ky | Bath |
| 9358 | Kentucky Milling Co | Kenderson, Ky | Newport |
| 9308 | Kentucky Milling Co | Henderson, Ky | Newport |
| 9347 | Judson Bangs | Henderson, Ky | Sabattus |
| 9348 | A. C. McCrillis | | Norway |
| 9483 | A. E. Schurtleff | | South Paris |
| 9486 | R. H. Soule | | South Windham |
| 9488 | J. B. Ham & Co | | Lewiston |
| 9489 | O. Holway & Co | | Auburn |
| 9491 | C. A. McKenney | | Winterport |
| 9492 | F. S. Wingate | | Hallowell |
| 9352 | Kensell & Tabor | | Portland |
| 9323 | Doten Grain Co | | Waterville |
| 9320 | Doten Grain Co | | Newport |
| 9312 | C. W. Getchell | | Newport |
| 9318 | H. A. Hobbs | | Portland |
| 9493 | Acme Milling Co | Acme, Ind | Foxcroft |
| 9494 | American Cereal Co | Chicago, Ill | Biddeford |

ANALYSES OF SAMPLES.

| Names of Feed. | Protein. Found—per cent. | Protein. Guaranteed—per cent. | Fat. Found—per cent. | Fat. Guaranteed—per cent. | Station number. |
|---|---|---|---|---|---|
| Bowker's Animal Meal | 41.38 | 30.00 | 9.34 | 5.00 | 9453 |
| Bowker's Animal Meal | 39.19 | 30.00 | 9.08 | 5.00 | 9434 |
| Old Fashioned Beef Scrap | 45.81 | 40.00 | 25.80 | 15.00 | 9455 |
| Philbrick's Meat Meal | 29.25 | | | | 9333 |
| Smith & Romaines Evaporated Boiled Beef and Bone for Poultry | 38.63 | 45.00 | 18.98 | 15.00 | 9456 |
| Beef Scrap for Poultry | 65.19 | 50.00 | 10.26 | 9.00 | 9457 |
| Beef Scrap | 62.63 | | 18.12 | | 9364 |
| Quaker Dairy Feed | 14.25 | 12.03 | 3.83 | 2.50 | 9459 |
| Quaker Dairy Feed | 14.13 | 12.03 | 4.25 | 2.50 | 9461 |
| Quaker Dairy Feed | 14.19 | 12.03 | 3.92 | 2.50 | 9462 |
| Quaker Dairy Feed | 12.88 | 13.00 | 4.18 | 3.25 | 9460 |
| Victor Corn and Oat Feed | 9.44 | 8.23 | 3.75 | 3.00 | 9463 |
| Victor Corn and Oat Feed | 8.38 | 8.23 | 4.65 | 3.00 | 9464 |
| Victor Corn and Oat Feed | 9.63 | 8.23 | 4.38 | 3.00 | 9465 |
| Victor Corn and Oat Feed | 10.94 | 8.23 | 4.62 | 3.00 | 9466 |
| Vim Oat Feed | 10.31 | 6.3 | 2.83 | 2.38 | 9467 |
| Schumacher's F. S. Stock Feed or Corn Oats and Barley | 12.56 | 10.72 | 5.07 | 3.26 | 9468 |
| De-Fi Corn and Oat Feed | 9.63 | 8.30 | 3.29 | 3.00 | 9469 |
| De-Fi Corn and Oat Feed | 12.19 | 8.30 | 3.73 | 3.00 | 9470 |
| De-Fi Corn and Oat Feed | 9.94 | 8.30 | 3.19 | 3.00 | 9471 |
| De-Fi Corn and Oat Feed | 10.25 | 8.30 | 3.99 | 3.00 | 9553 |
| Friend's Concen Kiln Dried Dairy Food | 8.81 | 10.9 | 3.41 | 3.7 | 9472 |
| Haskell's Oat Feed | 10.19 | 12.00 | 6.10 | 6.25 | 9473 |
| Yankee Corn and Oat Feed | 7.56 | 8.96 | 2 73 | 4.33 | 9474 |
| Yankee Corn and Oat Feed | 7.44 | 8.96 | 2.86 | 4.33 | 9475 |
| Yankee Corn and Oat Feed | 7.81 | 8.96 | 2.89 | 4.33 | 9476 |
| The H-O Co.'s Dairy Feed | 18.81 | 18.00 | 4.12 | 4.5 | 9477 |
| The H-O Co.'s Horse Feed | 13.06 | 12.00 | 4.74 | 4.5 | 9478 |
| The H-O Co.'s Poultry Feed | 18.19 | 17.00 | 5.05 | 5.5 | 9479 |
| The H-O Co.'s Scratching Feed for Poul. | 13.19 | | 4.17 | | 9480 |
| Argyle Oat Feed | 6.00 | 12.03 | 2.09 | 2.50 | 9481 |
| Viking's Dairy Feed | 6.06 | | 2.63 | | 9411 |
| Corn and Oat Feed | 9.00 | | 5.31 | | 9303 |
| Jersey Mixed Feed | 11.81 | 12.00 | 3.69 | 3.00 | 9482 |
| Jersey Mixed Feed | 10 00 | | 3.14 | | 9484 |
| Jersey Mixed Feed | 10.25 | | 3.52 | | 9358 |
| Jersey Mixed Feed | 11.25 | 11.50 | 3.59 | 3.50 | 9308 |
| Kentucky Mixed Feed | 11.81 | | 4.05 | | 9347 |
| Kentucky Mixed Feed | 12.81 | | 4.38 | | 9348 |
| Kentucky Mixed Feed | 12.31 | | 3 40 | | 9488 |
| Mixed Feed | 11.50 | | 2.85 | | 9486 |
| Mixed Feed | 11.38 | | 3.61 | | 9488 |
| Mixed Feed | 11.19 | | 2.58 | | 9489 |
| Mixed Feed | 11.69 | | 3.54 | | 9491 |
| Mixed Feed | 11.94 | | 3.74 | | 9492 |
| Mixed Feed | 10.75 | | | | 9352 |
| Mixed Feed | 7.25 | | | | 9323 |
| Mixed Feed | 8.26 | | | | 9320 |
| Mixed Feed | 11.50 | | | | 9312 |
| Mixed Feed | 11.13 | | | | 9318 |
| Acme Feed | 16.94 | | | | 9493 |
| Buckeye Wheat Feed | 17.81 | 18.21 | | | 9494 |

MANUFACTURERS AND PLACE OF SAMPLING.

| Station number. | Manufacturer or Dealer. | Manufactured at | Sampled at |
|---|---|---|---|
| 9495 | American Cereal Co | Chicago, Ill | Camden |
| 9496 | Ansted & Burke | Springfield, Ohio | Camden |
| 9497 | R. H. Soule | | South Windham |
| 9498 | C. B. Cummings & Son | | Norway |
| 9499 | Blish Milling Co | Seymour, Ind | Portland |
| 9500 | Blish Milling Co | Seymour, Ind | Lewiston |
| 9296 | Commercial Milling Co | Detroit, Mich | Brownville |
| 9501 | W. A. Coombs Milling Co | Coldwater, Mich | South Windham |
| 9502 | Halle & Sons | Iona & Lyons, Mich | Norway |
| 9503 | Hunter Brothers | St. Louis, Mo | Winthrop |
| 9504 | Imperial Mill Co | Duluth, Minn | Bath |
| 9505 | King Milling Co | Lowell, Mich | Norway |
| 9506 | Lawrenceburg Roller Mills Co. | Lawrenceburg, Ind | Bath |
| 9334 | Henry Littlefield & Co | | Portland |
| 9336 | Henry Littlefield & Co | | Portland |
| 9507 | Minkota Milling Co | Minkota, Minn | West Falmouth |
| 9508 | R. P. Moore Milling Co | Princeton, Ind | Biddeford |
| 9509 | Portland Milling Co | Portland, Mich | Hiram |
| 9510 | Portland Milling Co | Portland, Mich | Foxcroft |
| 9332 | Portland Milling Co | Portland, Mich | |
| 9356 | Portland Milling Co | Portland, Mich | Newport |
| 9511 | M. G. Rankin & Co | Milwaukee, Wis | Bath |
| 9357 | M. G. Rankin & Co | Milwaukee, Wis | Newport |
| 9512 | M. G. Rankin & Co | Milwaukee, Wis | Portland |
| 9513 | F. W. Stock | Hillsdale, Mich | Brownfield |
| 9361 | David Stott | Detroit, Mich | Newport |
| 9514 | Valley City Milling Co | Grand Rapids, Mich | Brownfield |
| 9345 | Valley City Milling Co | Grand Rapids, Mich | Cumberland |
| 9515 | Walsh DeRoo Milling Co | | Waterville |
| 9516 | Washburn & Crosby Co | Minneapolis, Minn. | Portland |
| 9517 | Washburn & Crosby Co. | Minneapolis, Minn. | Norway |
| 9518 | Andrews & Horigan Co. | | Biddeford |
| 9519 | C. E. Fox | | Fryeburg |
| 9520 | C. H. Reed | | Richmond |
| 9521 | E. D. Walker | | Brownfield |
| 9326 | | | Mars Hill |
| 9327 | | | Silver's Mills |
| 9317 | Zenith Milling Co | | Portland |
| 9490 | Ginn & Field | | Belfast |
| 9346 | | | Cumberland |
| 9485 | D. & C. E. Scribner | | Brunswick |
| 9487 | Frye & Porter | | Camden |
| 9522 | Albion Milling Co | Albion, Mich | Saco |
| 9523 | C. B. Cummings & Son | | Norway |
| 9285 | Fenton Milling Co. | Fenton, Mich | Brownville |
| 9524 | Dow and King | Springfield, Ill | Lewiston |
| 9525 | Goshen Milling Co | Goshen, Ind | Norway |
| 9526 | Hicks Brown Milling Co. | Minneapolis, Minn | Augusta |
| 9527 | Hunter Brothers | St. Louis, Mo | Winthrop |
| 9528 | Hunter Brothers | St. Louis, Mo | Readfield |
| 9315 | E. Merritt & Sons | Houlton, Maine | Houlton |
| 9529 | Northwestern Consol. Mill. Co. | Minneapolis, Minn. | Hiram |

ANALYSES OF SAMPLES.

| Name of Feed. | Protein. | | Fat. | | Station number. |
|---|---|---|---|---|---|
| | Found—per cent. | Guaranteed—per cent. | Found—per cent. | Guaranteed—per cent. | |
| Buckeye Wheat Feed | 17.81 | 18.21 | | | 9495 |
| Mixed Feed | 17.56 | | | | 9496 |
| Ballard's Mixed Feed | 17.81 | | | | 9497 |
| Ballard's Mixed Feed | 17.56 | | | | 9498 |
| Mixed Feed | 17.63 | | | | 9499 |
| Winter Wheat Mixed Feed | 17.56 | | | | 9500 |
| Fancy Winter Wheat Mixed Feed | 16.75 | | | | 9296 |
| Mixed Feed | 16.81 | | | | 9507 |
| Fancy Bran and Middlings | 17.56 | | | | 9502 |
| Sunshine Mixed Feed | 15.94 | | | | 9503 |
| Boston Mixed Feed | 19.44 | | | | 9504 |
| Choice Mixed Feed | 17.56 | | | | 9505 |
| Snowflake Mixed Feed | 17.81 | | | | 9506 |
| Maine Mixed Feed | 17.88 | | | | 9334 |
| Portland Mixed Feed | 17.69 | | | | 9336 |
| Best Minkota Mixed Feed | 18.38 | | | | 9507 |
| King Feed | 16.56 | | | | 9508 |
| Champion Mixed Feed | 16.94 | | | | 9509 |
| Champion Mixed Feed | 16.06 | | | | 9510 |
| Champion Mixed Feed | 16.00 | | | | 9332 |
| Champion Mixed Feed | 16.70 | | | | 9356 |
| Elgin Pure Bran and Middlings | 18.31 | | | | 9511 |
| Elgin Pure Bran and Middlings | 18.50 | | | | 9357 |
| Standard Mixed Feed | 17.81 | | | | 9512 |
| M. F. Mixed Feed | 17.19 | | | | 9513 |
| Stott's Mixed Feed | 14.63 | | | | 9361 |
| Farmer's Fav. Mixed Win. Wh't Cow F'd | 16.31 | | | | 9514 |
| Farmer's Fav. Mixed Win. Wh't Cow F'd | 17.19 | | | | 9345 |
| Mixed Feed | 16.25 | | | | 9515 |
| Superior Mixed Feed | 17.88 | | | | 9516 |
| Superior Mixed Feed | 19.56 | | | | 9517 |
| Winter Wheat Crescent Mixed Feed | 17.19 | | | | 9518 |
| Winter Wheat Crescent Mixed Feed | 17.75 | | | | 9519 |
| S. Pure Wheat Bran and Middlings | 17.31 | | | | 9520 |
| Kehlor Brand Mixed Feed | 17.06 | | | | 9521 |
| Mixed Feed | 16.50 | | | | 9326 |
| Mixed Feed | 16.38 | | | | 9327 |
| Winter Wheat Mixed Feed | 17.88 | | | | 9317 |
| Mixed Feed | 15.56 | | | | 9490 |
| Mixed Feed | 15.50 | | | | 9346 |
| Mixed Feed | 14.44 | | | | 9485 |
| B. Mixed Feed | 17.56 | | | | 9487 |
| Winter Wheat Bran | 14.81 | | | | 9522 |
| Ballard's Bran | 16.19 | | | | 9523 |
| Bran | 15.44 | | | | 9295 |
| Winter Wheat Bran | 14.69 | | | | 9524 |
| Bran | 17.19 | | | | 9525 |
| Bran | 18.06 | | | | 9526 |
| Empire Bran | 16.19 | | | | 9527 |
| Hunter's Extra Bran | 17.56 | | | | 9528 |
| Bran | 12.75 | | | | 9315 |
| Bran | 17.19 | | | | 9529 |

MANUFACTURERS AND PLACE OF SAMPLING.

| Station number. | Manufacturer or Dealer. | Manufactured at | Sampled at |
|---|---|---|---|
| 9330 | Pillsbury-Washburn Fl. M'ls Co | Minneapolis, Minn. | Camden |
| 9351 | Partridge Brothers. | | Norway Lake |
| 9531 | S. B. & Co | Beardstown, Ill. | Camden |
| 9532 | David Stott | Detroit, Mich | Skowhegan |
| 9533 | David Stott | Detroit, Mich | Pittsfield |
| 9534 | George Ulers Milling Co | | Waterville |
| 9535 | Voigt Milling Co | Grand Rapids, Mich | Brunswick |
| 9536 | Voigt Milling Co | Grand Rapids, Mich | Stroudwater |
| 9362 | Voigt Milling Co | Grand Rapids, Mich | Newport |
| 9537 | Washburn & Crosby Co | Minneapolis, Minn. | Brunswick |
| 9298 | Washburn & Crosby Co | Minneapolis, Minn. | Portland |
| 9297 | | | Brownville |
| 9311 | | | Newport |
| 9313 | | | East Newport |
| 9316 | | | Portland |
| 9325 | | | Otisfield |
| 9331 | | | |
| 9538 | | | South Windham |
| 9539 | | | Bangor |
| 9540 | | | South Brewer |
| 9541 | | | Pittsfield |
| 9542 | Ansted and Burke Co | Springfield, Ohio | Foxcroft |
| 9543 | C. B. Cummings & Son | | Norway |
| 9544 | Dow and King | Springfield, Ohio | Readfield |
| 9545 | Pillsbury-Washburn Fl. M'ls Co | Minneapolis, Minn. | Fryeburg |
| 9359 | Pillsbury-Washburn Fl. M'ls Co | Minneapolis, Minn. | Newport |
| 9546 | David Stott | Detroit, Mich | Lewiston |
| 9547 | Valley City Milling Co | Grand Rapids, Mich | Hiram |
| 9363 | Voigt Milling Co | Grand Rapids, Mich | Newport |
| 9548 | | | Bath |
| 9309 | | | Newport |
| 9310 | | | Newport |
| 9349 | | | Norway |
| 9353 | | | Norway |
| 9360 | | | Newport |
| 9549 | Pillsbury-Washburn Flour Mills | Minneapolis, Minn. | Fryeburg |
| 9550 | Pillsbury-Washburn Flour Mills | Minneapolis, Minn. | Camden |
| 9209 | Pillsbury-Washburn Flour Mills | Minneapolis, Minn. | Waldo Station |

ANALYSES OF SAMPLES.

| Name of Feed. | Protein. Found—per cent. | Protein. Guaranteed—per cent. | Fat. Found—per cent. | Fat. Guaranteed—per cent. | Station number. |
|---|---|---|---|---|---|
| Pillsbury's Bran | 17.13 | | | | 9350 |
| Bran | 16.13 | | | | 9351 |
| Bran | 15.19 | | | | 9331 |
| Stott's Pure Winter Wheat Bran | 14.94 | | | | 9332 |
| Stott's Pure Winter Wheat Bran | 15.38 | | | | 9333 |
| Fancy Bran | 16.56 | | | | 9334 |
| Voigt's Choice Winter Wheat Bran | 17.81 | | | | 9335 |
| Voigt's Choice Winter Wheat Bran | 16.31 | | | | 9336 |
| Voigt's Choice Winter Wheat Bran | 17.00 | | | | 9362 |
| Coarse Bran | 17.69 | | | | 9337 |
| Coarse Bran | 14.88 | | | | 9298 |
| Winter Wheat Bran | 17.88 | | | | 9297 |
| Bran | 15.13 | | | | 9311 |
| Bran | 15.38 | | | | 9313 |
| Bran | 17.00 | | | | 9316 |
| Bran | 17.13 | | | | 9325 |
| Bran | 16.38 | | | | 9331 |
| Bran | 17.75 | | | | 9338 |
| Winter Wheat White Bran | 15.56 | | | | 9339 |
| Bran | 17.69 | | | | 9340 |
| Andrew's Fancy Middlings | 21.44 | | | | 9341 |
| Middlings | 18.19 | | | | 9342 |
| Ballard's Middlings | 17.81 | | | | 9343 |
| Winter Wheat Middlings | 16.94 | | | | 9344 |
| Pillsbury's A Middlings | 22.19 | | | | 9345 |
| Pillsbury's Middlings | 18.88 | | | | 9359 |
| Stott's Climax Middlings | 18.31 | | | | 9346 |
| Choice Winter Wheat Middlings | 17.88 | | | | 9347 |
| Voigt's Choice Winter Wheat Middlings | 17.50 | | | | 9363 |
| Middlings | 17.69 | | | | 9348 |
| Middlings | 18.00 | | | | 9309 |
| Middlings | 20.63 | | | | 9310 |
| Middlings | 18.56 | | | | 9349 |
| Middlings | 17.56 | | | | 9353 |
| Red Dog | 21.25 | | | | 9360 |
| Pillsbury's XX Daisy | 21.94 | | | | 9349 |
| Pillsbury's XX Daisy | 21.81 | | | | 9350 |
| Pillsbury's XX Daisy | 18.00 | | | | 9299 |

SUMMARY OF ANALYSES.

| | Number of analyses. | | Protein. | | Fat. | |
|---|---|---|---|---|---|---|
| | | | Found—per cent. | Guaranteed—per cent. | Found—per cent. | Guaranteed—per cent. |
| R. W. Biggs & Co. "Canary" Brand Cotton Seed Meal. | 4 | Highest | 47.06 | ..... | 12.58 | |
| | | Lowest | 46.25 | 43.00 | 9.21 | 9.00 |
| | | Average | 46.53 | ..... | 10.33 | |
| F. W. Brodé & Co. Owl Brand Pure Cotton Seed Meal. | 6 | Highest | 47.75 | ..... | 10 39 | |
| | | Lowest | 43.06 | 43.00 | 8.09 | 9.00 |
| | | Average | 45.87 | ..... | 9.37 | |
| Chapin & Co. Cotton Seed Meal. | 1 | ..... | 45.63 | 43.00 | 8.04 | 9.00 |
| Doten Grain Co. Cotton Seed Meal. | 2 | Highest | 47.50 | ..... | 10.26 | |
| | | Lowest | 47.13 | 43.00 | 9.15 | 9.00 |
| | | Average | 47.32 | ..... | 9.70 | |
| Humphreys, Goodwin & Co. Dixie Brand Cotton Seed Meal | 4 | Highest | 45.65 | ..... | 10.39 | |
| | | Lowest | 43.88 | 43.00 | 8.42 | 9.00 |
| | | Average | 44.36 | ..... | 9.73 | |
| Hunter Brothers. Cotton Seed Meal. | 5 | Highest | 49.31 | ..... | 10.90 | |
| | | Lowest | 44.88 | 43.00 | 8.13 | 9.00 |
| | | Average | 46.80 | ..... | 10.00 | |
| J. E. Soper & Co. Cotton Seed Meal. | 6 | Highest | 48.63 | ..... | 10.30 | |
| | | Lowest | 42.69 | 43.00 | 8.44 | 9.00 |
| | | Average | 45.46 | ..... | 9.10 | |
| The American Cotton Oil Co. Prime Cotton Seed Meal. | 13 | Highest | 46.94 | ..... | 11.27 | |
| | | Lowest | 40.00 | 43.00 | 8.73 | 9.00 |
| | | Average | 44.46 | ..... | 9.97 | |
| Green Diamond Brand Cotton Seed Meal. | 3 | Highest | 46.88 | ..... | 12.91 | |
| | | Lowest | 45.13 | 43.00 | 8.19 | 9 00 |
| | | Average | 45.88 | ..... | 9.92 | |
| Star Brand Cotton Seed Meal. | 2 | Highest | 47.25 | ..... | 11.98 | |
| | | Lowest | 44.63 | 43.00 | 10.11 | 9.00 |
| | | Average | 45.94 | ..... | 11.05 | |
| Manufacturers unknown. Cotton Seed Meal. | 2 | Highest | 44.75 | ..... | 9.54 | |
| | | Lowest | 43.00 | 43.00 | 8.45 | 9.00 |
| | | Average | 43.88 | ..... | 9.00 | |
| Manufacturers unknown. Cotton Seed Meal. | 2 | Highest | 46.44 | ..... | 9.60 | |
| | | Lowest | 43.06 | 41.00 | 8.31 | 9.00 |
| | | Average | 44.75 | ..... | 8.96 | |
| Manufacturers unknown, unguaranteed. Cotton Seed Meal. | 10 | Highest | 47.44 | ..... | 11.68 | |
| | | Lowest | 44.32 | ..... | 7.70 | |
| | | Average | 45.95 | ..... | 9.91 | |
| All samples of Cotton Seed Meal analyzed in 1901. | 61 | Highest | 49.31 | 43.00 | 12.91 | |
| | | Lowest | 40.00 | 41.00 | 7.70 | 9.00 |
| | | Average | 45.52 | ..... | 9.73 | |
| Glucose Sugar Refining Co. Chicago Gluten Meal. | 8 | Highest | 37.38 | 39.00 | 6.33 | 3.00 |
| | | Lowest | 33.69 | 38.00 | 1.27 | 2.00 |
| | | Average | 36.28 | ..... | 3.83 | |
| Chas. Pope Glucose Co. Cream Gluten Meal. | 7 | Highest | 41.44 | ..... | 5.51 | |
| | | Lowest | 33.38 | 34.12 | 1.14 | 3.20 |
| | | Average | 37.82 | ..... | 4.18 | |

SUMMARY OF ANALYSES—CONTINUED.

| | Number of analyses. | | Protein. | | Fat. | |
|---|---|---|---|---|---|---|
| | | | Found—per cent. | Guaranteed—per cent. | Found—per cent. | Guaranteed—per cent. |
| National Starch Co. King Gluten Meal. | 8 | Highest | 38.00 | 39.00 | 4.27 | 4.30 |
| | | Lowest | 31.63 | 32.4 | 2.25 | 3.20 |
| | | Average | 35.51 | .. ..... | 3.19 | |
| Glucose Sugar Refining Co. Davenport Gluten Feed. | 3 | Highest | 26.69 | .... .... | 4.92 | |
| | | Lowest | 23.31 | 27.5 | 4.67 | 3.30 |
| | | Average | 25.08 | ..... | 4.84 | |
| Glucose Sugar Refining Co. Buffalo Gluten Feed. | 1 | ..... .. ... | 25.88 | 27.5 | 5.55 | 3.30 |
| National Starch Co. Queen Gluten Feed. | 1 | .... .... | 24.19 | 23.6 | 1.95 | 2.20 |
| Glucose Sugar Refining Co. Germ Oil Meal. | 3 | Highest | 24.06 | 25.5 | 12.70 | 10.50 |
| | | Lowest | 22.13 | 25.3 | 10.30 | 3.00 |
| | | Average | 23.64 | ..... .. | 11.14 | |
| American Milling Co. Sucrene Oil Meal. | 1 | ..... | 28.25 | 25.00 | 7.34 | 3.50 |
| J. W. Barwell. Blatchford's Calf Meal. | 1 | ..... | 26.00 | 26.00 | 4.91 | 5.00 |
| American Linseed Co. Cleveland Flax Meal. | 3 | Highest | 40.50 | ..... | 2.21 | |
| | | Lowest | 38.69 | 37.5 | 1.57 | 1.00 |
| | | Average | 39.69 | ..... ... | 1.94 | |
| Hunter Brothers. Linseed Meal. | 2 | Highest | 34.19 | ..... | 9.41 | |
| | | Lowest | 33.88 | 34.00 | 9.13 | 6.50 |
| | | Average | 34.04 | ..... | 9.27 | |
| American Ag. Chem. Co. Bradley's Superior Meat Meal. | 2 | Highest | 52.63 | ..... .... | 9.50 | |
| | | Lowest | 47.69 | 40.00 | 8.88 | 8.00 |
| | | Average | 50.16 | ... ..... | 9.19 | |
| The Bowker Co. Bowker's Animal Meal. | 2 | Highest | 41.38 | ..... | 9.34 | |
| | | Lowest | 37.06 | 30.00 | 9.08 | 5.00 |
| | | Average | 39.21 | ..... | 9.19 | |
| Lowell Fertilizer Co. Old Fashioned Beef Scrap. | 1 | ..... ..... | 45.81 | 40.00 | 25.80 | 15.00 |
| E. J. Philbrick. Philbrick's Meat Meal. | 1 | ..... ..... | 29.25 | | | |
| D. W. Romaine. Smith & Romaine's Evaporated and Boiled Beef and Bone for Poultry. | 1 | .... ..... | 38.63 | 45.00 | 18.98 | 15.00 |
| Noyes & Pearson, Beef Scrap. | 1 | ..... ..... | 65.19 | 50.00 | 10.26 | 9.00 |
| Kendall & Whitney. Beef Scrap. | 1 | ..... | 62.63 | ..... ... | 18.12 | |
| American Cereal Co. Quaker Dairy Feed. | 4 | Highest | 14.25 | ... .... | 4.25 | 3.25 |
| | | Lowest | 12.88 | 13.00 | 3.83 | 2.50 |
| | | Average | 13.86 | 12.03 | 4.05 | |

SUMMARY OF ANALYSES—CONCLUDED.

| | Number of analyses. | | Protein. | | Fat. | |
|---|---|---|---|---|---|---|
| | | | Found — per cent. | Guaranteed — per cent. | Found — per cent. | Guaranteed — per cent. |
| American Cereal Co. Victor Corn and Oat Feed | 4 | Highest | 10.94 | ..... | 4.65 | |
| | | Lowest | 8.38 | 8.23 | 3.75 | 3.00 |
| | | Average | 9.60 | ..... | 4.35 | |
| American Cereal Co. Vim Oat Feed. | 1 | ..... ..... | 10.31 | 6.30 | 2.83 | 2.38 |
| American Cereal Co. Schumacher's F. S. Stock Feed | 1 | ..... ... | 12.56 | 10.72 | 5.07 | 3.26 |
| Ellsworth & Co. De-Fi Corn and Oat Feed. | 4 | Highest | 12.19 | ..... | 3.99 | |
| | | Lowest | 9.63 | 8.30 | 3.19 | 3.00 |
| | | Average | 10.50 | ..... ... | 3.55 | |
| Great Western Cereal Co. Friends Concentrated Dairy Food. | 1 | ..... .... | 8.81 | 10.9 | 3.41 | 3.7 |
| W. H. Haskell & Co. Haskell's Oat Feed. | 1 | ..... ..... | 10.19 | 12.00 | 6.10 | 6.25 |
| H. R. Heath & Son. Yankee Corn and Oat Feed. | 3 | Highest | 7.81 | ..... | 2.89 | |
| | | Lowest | 7.44 | 8.96 | 2.73 | 4.33 |
| | | Average | 7.60 | .. .. ... | 2.83 | |
| The H-O Co. | | | | | | |
| The H-O Co.'s Dairy Feed. | 1 | .. ..... | 18 81 | 18.00 | 4.12 | 4.50 |
| The H-O Co.'s Horse Feed. | 1 | ..... ..... | 13.06 | 12.00 | 4.74 | 4.5 |
| The H-O Co.'s Poultry Feed. | 1 | ..... .... | 18.19 | 17.00 | 5.05 | 5.5 |
| The H-O Co.'s Scrathing Feed. | 1 | .... . .... | 13.19 | ..... | 4.17 | |
| Norton, Chapman Co. Argyle Oat Feed. | 1 | ..... | 6.00 | 12.03 | 2.09 | 2.50 |
| Manufacturer unknown. Viking Dairy Feed. | 1 | .... ..... | 6.06 | ..... | 2.63 | |
| Kentucky Milling Co. Jersey Mixed Feed. | 4 | Highest | 11.81 | 12.00 | 3.69 | 3.5 |
| | | Lowest | 10.00 | 11.5 | 3.14 | 3.00 |
| | | Average | 10.83 | ..... . | 3.49 | |
| Manufacturers unknown. Kentucky Mixed Feed. | 3 | Highest | 12.81 | . .... ... | 4.38 | |
| | | Lowest | 11.81 | ..... | 3.40 | |
| | | Average | 12.31 | ..... | 3.94 | |
| Manufacturers unknown. Mixed Feed. | 10 | Highest | 11.94 | ..... | 3.74 | |
| | | Lowest | 7.25 | ..... .... | 2.58 | |
| | | Average | 10.66 | ..... ... | 3.26 | |

## FOOD NUTRIENTS AND THEIR USES.

The valuable ingredients in animal foods are ash or mineral matter, protein, fat and a class of compounds called carbohydrates, of which starch, sugar and crude fiber are the most important examples. Although the ash or mineral matter is essential to the well being of the animal, it is abundantly supplied by most materials one is likely to feed, so what one most needs to consider in buying and using cattle foods are protein, fat and carbohydrates.

A sufficient supply of protein in the food is indispensable. The working animal depends upon it to replenish and repair its working machinery, the growing animal to make muscle and build up its whole system, the sheep to make wool and the milch cow to make the casein and albumen of its milk. No other substance can take its place, or be manufactured into protein by the body. When more protein is fed than is needed for the growth and repair of the body, the excess performs the same functions as the fats and carbohydrates. As a rule, however, this is not an economical use to make of it. It is worth but slightly more than the carbohydrates and about four-tenths as much as fat for this purpose and is commonly the most expensive ingredient to produce or buy.

The office of the other two substances, fat and carbohydrates, is two-fold: First, they serve as fuel and are oxidized or burned in the body to supply heat and force. The fat is worth about two and one-fourth times as much as the carbohydrates for that purpose. Second, they are used as material for making fat.

Most of the home grown food materials are rich in carbohydrates and relatively low in protein. Coarse foods, such as hay, stover, silage, etc., are in general far less digestible than the concentrated foods, such as oil meals, gluten meals, etc.

The intelligent purchaser of concentrated foods will buy, as far as possible, to supplement the home grown foods. Such a man goes to the dealer in feeding stuffs primarily to buy such foods as shall increase the digestible protein in the ration. While all concentrated feeding stuffs carry that which will materially increase the digestible matter of the ration, the oil and gluten meals are the richest in digestible protein, and thus it happens that the intelligent feeder of dairy stock usually buys this class of foods.

The offals (wheat bran, middlings and mixed feeds) from the milling of wheat are not quite so rich in protein, but they carry larger amounts of digestible mineral matters. For these reasons and because they are usually enough lower in price to warrant their purchase, the feeder of the more concentrated foods generally uses these offals.

### FEEDS LOW IN PROTEIN.

Very few farmers can afford to buy feeds low in protein and high in carbohydrates at any price at which they have been or are likely to be offered. The farmer should grow all the coarse feeds that he needs. Oat and similar feeds are very much like corn stalks or oat straw in composition. Some of these feeds have cottonseed or other nitrogenous feeding stuffs added to them so that they carry more protein than straight oat feeds, but these mixtures are always more expensive sources of protein than are the glutens, cottonseed and linseed meals. One hundred pounds of an ordinary oat feed has from eight to eleven pounds of protein. At seventy-five cents per hundred the protein costs from seven to nine cents a pound. One hundred pounds of a good gluten meal has from thirty-four to forty per cent of protein. At $1.50 per hundred the protein costs about four cents a pound and it not only costs but half as much per pound as the protein in an oat feed but it is much more digestible. As a source of protein, it would be as good economy to pay $60 a ton for high grade cottonseed meal as to pay $15 a ton for the ordinary oat feed.

### COTTONSEED MEAL.

Cottonseed meal is a by-product from the manufacture of cottonseed oil. After the cotton has been taken from the seed in the cotton gin, the remaining down or "linters" and the hard black seed coats or hulls are removed by machinery. The remnants of the seed are cooked, and the oil expressed by high pressure. The resulting cottonseed cake is ground into the bright yellow cottonseed meal of commerce. Such a meal carries from 40 to 50 per cent or even more protein.

Sometimes the black hulls are ground with the cake and a dark colored meal of very inferior feeding value is the result. Not all dark colored meal is necessarily adulterated with hulls, but strictly first-class *fresh* cottonseed meal is always bright and yellow.

The analyses of 61 samples are reported. The guaranteed percentages of protein for the cottenseed meal varied from 41 per cent to 43 per cent; the fat was all guaranteed 9 per cent.

The 61 samples carried from 40 to 49.31 per cent of protein with an average of 45.52 per cent. The fat ranged from 7.70 per cent to 12.91 per cent with an average of 9.73 per cent. No low grade cottonseed meal was found by the inspector and none has been sent by correspondents thus far during the season of 1901-2.

### GLUTEN MEALS AND FEEDS.

Gluten meals and gluten feeds are by-products left in the manufacture of starch and glucose from Indian corn. Corn consists largely of starch. The waste product from the manufacture of starch or sugar is relatively much richer in oil and protein than corn. Most factories are removing part of the corn oil from the waste, so that nearly all the gluten meals carry but little oil, e. g., Chicago Gluten Meal, which three years ago carried 7 to 9 per cent of fat, now has from 2.50 to 4 per cent. This reduction in fat is probably an advantage, as feeding corn oil to dairy animals seems to have a tendency to make softer butter. Gluten feeds differ from gluten meal chiefly in that they contain a good deal of the corn bran and hence relatively less of protein and digestible carbohydrates, and more of the indigestible woody fiber.

Chicago Gluten Meal is for the most part guaranteed to carry 38 per cent protein and 2 per cent fat. None of the samples examined came up to the guarantee in protein. The average of the samples examined was nearly 2 per cent below the guarantee. The goods are not as good as last year but resemble those offered in the State in the summer and fall of 1899.

Chas. Pope Glucose Company's Cream Gluten Meal is guaranteed 34.12 per cent protein and 3.20 per cent fat. The lowest sample carried 33.38 per cent and the highest 41.44 per cent protein, with an average of 37.82 per cent. Not only were those goods for the most part above the guaranteed per cent of protein, but they averaged the highest of the gluten meals examined.

The National Starch Company's King Gluten Meal carried guarantees in which the protein ranged from 32.4 to 39 per cent and the fat from 3.2 to 4.3 per cent. The protein in the samples analyzed ranged from 31.63 to 38 per cent. These goods aver-

aged a trifle lower in both protein and fat than Chicago Gluten Meal.

Davenport Gluten Feed and the Buffalo Gluten Feed carried the same guarantee, 27.5 per cent protein and 3.3 per cent fat. All the samples fell a little below in protein and were above the guarantee in fat.

Queen Gluten Feed carried about the same per cent of protein as the other two brands examined but carried a lower guarantee in both protein and fat. It was lower in fat than the others, agreeing quite closely with the guarantee.

Germ Oil Meal is a corn product which has been offered in the State for two or three years. It does not seem to be as generally distributed this year as last. Its composition is practically the same as last year. It carries nearly 2 per cent less protein than the guarantee. As a source of protein it is about as good as rather poor gluten feed and has less than two-thirds the value of good gluten meal. Only one sample of Sucrene oil meal was found. It carried more of protein and fat than called for by the guarantees. In composition it resembles a good gluten feed.

### LINSEED MEALS.

Linseed meal is made by grinding flax seed from which the oil has been more or less completely extracted. "Old Process" contains more fat and somewhat less protein than "New Process" linseed meal. The Cleveland Flax Meal is a linseed meal from which the fat has been thoroughly removed by extraction with naptha. The naptha is removed by treatment with steam which leaves a coarse flaky product. These goods are guaranteed to carry 37.5 per cent protein and 1 per cent fat. Each sample examined was above the guarantee.

Two samples of Hunter Bros. Old Process Linseed Meal agreed very closely with the guaranteed protein and carried considerably above the guaranteed 6.5 per cent of fat.

### MEAT MEALS AND SCRAPS.

These were with one exception above the guaranteed percentages in protein and fat. Evidently many of the manufacturers place the guarantee sufficiently low so there will be no danger of their goods falling below the guarantees. In compounding rations it will be safer to depend upon the analyses here given

than upon the guarantees. The beef scrap of Noyes and Pearson, carrying 65 per cent of protein, is an unusual one.

### BY-PRODUCTS OF THE OAT.

In the manufacture of oat products for human food, the kernel of the oat is separated from the hull. Oat hulls are in themselves, low in food value, being worth but little more than the same weight of oat straw. Their value may be materially greater if broken kernels or small oats are ground in with them. Manufacturers of oat products are putting ground oat hulls on the market in many forms and mixtures, such as oat feed, oat chop, corn and oat feed, chop, etc. The bulk of all these materials is ground oat hulls, with admixtures of oat kernels, ground corn, etc. The feeding value of them is variable, and they should never be bought except on a guaranteed composition, and then it should be remembered that the oat hulls are not as digestible as the kernel of oats or other grains. Unscrupulous dealers frequently sell "oat feeds" as ground oats, the unsuspecting buyer thinking he is getting the whole oat meal, which is much more valuable than most oat feeds.

The various oat feeds, corn chops and corn and oat feeds are still used in the State to a large extent. Some of these are the straight refuse from the manufacture of oat meal and others, like the H—O Company's goods, are mixtures of such refuse with other by-products of higher protein content. With a few exceptions they are well up to their respective guarantees and no fault can be found with the manufacturers for their desire to sell these goods, as they are making no claims for nutrients which the goods do not contain. Argyle Oat Feed and Viking Dairy Feed have a feeding value about equal to ground oat straw and the Yankee Corn and Oat Feed is little better. The intelligent buyer of feeding stuffs, who has his barns well filled with hay, corn fodder and silage, will have very little use for these feeds low in protein content.

### WHEAT BRAN AND MIDDLINGS.—MIXED FEED.

The results of analyses of samples of wheat offals sent to the Station by correspondents and collected by the inspector are given on pages 48 to 51.

In the Fall of 1899 the State was flooded with low grade, adulterated wheat brans and mixed feeds. Because of the pub-

licity given to these fradulent goods and the cooperation of the best of the large dealers they have quite largely disappeared or are sold under a proper guarantee.

There is so much profit in selling ground corn cobs and broom corn at the price of wheat bran that the consumer must ever be on the watch against this fraud. The safest thing is to buy only well known, reliable brands of this class of goods. The bulletin gives the names and analyses of many manufacturers of high class brans, and other wheat offals. If consumers will see to it that all of this class of feeds which they buy carries the name of the miller there will be little likelihood of their being defrauded. In case of any doubt, mail a sample to the Station and an analyses will be made and the results reported promptly and without any charge.

### THE WORKINGS OF THE LAW.

It is now a little over four years since the law regulating the sale of concentrated commercial feeding stuffs went into effect in this State. At its enactment it was the first attempt to regulate the sale of this class of maerials in this country, and it was with some apprehension that its executive officers undertook to see that its provisions were carried out. Some of the large manufacturers threatened that they would not send their goods into the State if they had to come under police regulations, and as the State of Maine was only a small consumer of commercial feeding stuffs, it looked as though it might be an easy matter to carry out this threat. The law had, however, been in existence only a few months before other states began to see the benefits which we were deriving. In less than a year Vermont enacted a law identical with ours and now nearly all of the large dairy States east of the Mississippi have enacted laws based upon the Maine Feed Inspection Law. This action on the part of other States has made the manufacturers much more willing to comply with the requirements of the law, and to-day nearly all the large manufacturing concerns are placing upon their goods guarantees of their protein and fat, whether they are intended for States that have Feed Inspection Laws or have not.

In 1896, so far as the small number of samples sent in by correspondents could indicate, low grade cottonseed meal was abundant in the market. The law went into effect October 1,

1897. The following tabulation shows the number and character of samples of cottonseed meal sent to the Station by correspondents and collected by the inspector, beginning with the winter of 1897-8. Under high grade are included samples carrying from 42 to 52 per cent of protein. With one exception (in 1900-01) all of the low grade samples carried less than 26 per cent protein.

SAMPLES OF COTTONSEED MEAL EXAMINED.

| Winter of | High grade. | Low grade. | Total. |
|---|---|---|---|
| 1897-8 | 56 | 12 | 68 |
| 1898-9 | 103 | 4 | 107 |
| 1899-1900 | 95 | 4 | 99 |
| 1900-1 | 57 | 4* | 61 |
| 1901-2 | 58 | 0 | 58 |

*3 from same lot.

None of the low grade goods in 1897-8 were guaranteed as low grade. Eight of the samples of low grade goods found in the later years were guaranteed to carry less than 25 per cent of protein and the consumer had only himself to blame if he bought them for what they did not claim to be.

That low grade cottonseed meal has practically disappeared from the Maine market is a fact. It is also a fact that this disappearance began after the law was enacted and has steadily progressed. During the present season neither the correspondents of the Station nor its inspector have thus far found a single sample of low grade cottonseed meal in the Maine market. If the law regulating the sale of concentrated feeding stuffs has accomplished nothing else, this driving low grade cottonseed meal out of the Maine market is worth to the agriculture of the State more than the cost of inspection.

## Food Frauds and Humbugs.

Although they do not come under the provisions of the Feeding Stuffs Law, there are certain materials of a more or less fraudulent nature offered in our markets to stock men and others about which words of warning offered in the past must be repeated. The most recent is the

## "RED ALBUMEN."

In common with poultry feeders and farmers in other parts of the country residents of Maine have recently been somewhat disturbed from their usual mental balance by the exploiting of Red Albumen. The following is from a recent publication of the New York Experiment Station:

"There are at least two preparations sold under the name red albumen, probably more; for the druggists in many places were evidently not supplied with the original material, but realized that the farmers were determined to be 'gold-bricked' anyway and so met the demand by substituting compounds from their own stock. One of the preparations, that reaching the Station under the label of the United States Salyx Company, New Concord, Ohio, has practically no feeding value as it contains only .1 per cent of protein (albumen) the remainder being almost wholly oxide of iron (red paint) and sand. No phosphorus was found, nor was there any evidence of strichnine or the newly discovered (?) 'alequet.' Unless fraud has been worked upon the Salyx Company, this is the original 'red albumen.' If so, instead of being worth 50 or 60 cents a pound, it is worth only from 1 to 2 cents a pound as 'Mineral Red' or 'Ground Iron Ore' used for paint.

"Druggists, or others who have substituted some other product for the original 'red albumen,' have been less conscienceless toward the farmers; for they have sold them an albuminous compound, probably a by-product, which contains 11 or 12 per cent of nitrogen or about 72 per cent protein. This sells for varying prices, depending upon the druggist's mood; but usually at the price fixed for the original article, 50 or 60 cents a pound. Animal meal, which supplies the best of albuminoid matter for poultry, contains more than half as much protein and sells at from 3 to 5 cents a pound."

## CONDIMENTAL FOODS.

The subject is an old one. The report of this Station for 1885 discussed this subject and the statements then made of which the following is a type are true to-day. "The foods have no greater nutritive value than the feeding stuffs from which they are made, while the small quantities of fenugreek and sulphur are utterly

valueless to a well animal and a poor reliance as a means of curing a sick one. If an animal is well he only needs plenty of good food—if he is sick the wise course is to employ remedial agents suited to the case."

In 1895 in Bulletin 20 Dr. Jordan, at that time director of this Station, summed up all that seemingly need be said in the following

*"Facts to be Remembered.*

"(1) The mixture of ingredients contained in the ordinary foods comprises all that are known either to practice or science as useful to animal life.

"(2) The ordinary cattle foods supply animal nutrition in the most useful and economical forms.

"(3) Condimental foods are absurd as medicines. If an animal is well no medicine is needed, if ill, remedies adapted to the case should be administered.

"(4) The farmer could manufacture his own "condimental" food at a fraction of their usual cost, by mixing a small amount of such common substances as salt, sulphur, saltpeter, fenugreek, caraway, etc., with the daily ration."

But a fraud dies hard. It is to be hoped that the manufacturers of this class of materials flourish "not on the ignorance of farmers but on that lingering remnant of old times, which made saltpeter and sulphur the universal cure-all for horses and cattle."

The condimental foods most extensively advertised in this State for cattle are Nutriotone, International Stock Food and Baum's Stock Food. Mr. Winton, the expert of the Connecticut Experiment Station, is the only station worker in New England with the skill and knowledge necessary to microscopic identification of the various materials which are used in these mixturers, and the following is founded upon the results of his examinations as published in the bulletins and reports of that station.

Nutriotone consists chiefly of linseed meal, corn meal, wheat feed, cottonseed meal, fenugreek, salt, charcoal and sulphur. The International Stock Food consists principally of wheat feed, cayenne, a bitter drug which is probably gentian, salt and charcoal; while Baum's Stock Food is made up of linseed meal, charcoal, salt, Epsom salts and sulphur.

Fortunately in the condimental foods offered, injurious drugs are not found. In addition to common feeding stuffs they consist for the most part of old-time simple remedies of mildly curative powers. The claims made for these materials are as ridiculously extravagant as those made for patent medicines designed for the use of man. The absurd testimonials used in their support are doubtless genuine, but are made by people who can not or do not understand the relations of cause and effect.

These condimental foods are sold in prices ranging from 12 to 25 cents a pound. "As foods pure and simple such prices ($240 to $500 a ton) are ridiculous and prohibitive." If in large lots they can be bought at half or quarter these prices "even such a discount would make them twice as costly as our most expensive standard foods, and no one of them is as concentrated a feed as either cottonseed meal, linseed meal, or gluten meal. There is absolutely no sense in buying at a very high price a lot of drugs of rather mild medicinal properties of unknown kinds and unknown proportions, which claim to take the place of a part of the food and to cure almost every ill and defect that cattle and fowls* are heir to. Salt, charcoal, Epsom salts, sulphur, fenugreek, gentian, cayenne and ginger; they can all be bought in any village, they are already in the stables of many dairy farmers and are used by them. Their value is well known, and also their uselessness for the treatment of serious illnesses."

*"It is interesting to note that the poultry foods are very like the cattle foods, both in chemical composition and in materials used, so that were the claims of the manufacturers all valid, a condimental food which would cure gaps in chickens might be expected to increase the flow of milk of cows and also to cure hog cholera."

# FERTILIZER INSPECTION.

CHAS. D. WOODS, Director.
J. M. BARTLETT, Chemist in Charge of Fertilizer Analysis.

The law regulating the sale of commercial fertilizers in this State calls for two bulletins each year. The first of these contains the analyses of the samples received from the manufacturer, guaranteed to represent, within reasonable limits, the goods to be placed upon the market later. The second bulletin contains the analyses of the samples collected in the open market by a representative of the Station.

In the tables which follow the discussion there are given the results of the analyses of the manufacturers' samples of licensed brands. The tables include all the brands which have been licensed to March 1, 1902. Dealers are cautioned against handling any brands not given in this list without first writing the Station.

The figures which are given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the guarantee. If, for instance, the guarantee is 2 to 3 per cent of nitrogen, it is evident that the dealer cannot be held to have agreed to furnish more than 2 per cent and so this percentage is taken as actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples.

To produce profitable crops and at the same time to maintain and even to increase the productive capacity of the soil may rightly be termed "good farming." Many farmers are able to do this, and the knowledge of how to do it has been largely acquired through years of experience, during which the character

of the soil, its adaptability for crops, and the methods of its management and manuring have been made the subjects of careful study, without, however, any definite and accurate knowledge concerning manures and their functions in relation to soils and crops. To those who desire to study this question, the Station will on application, send a list of suitable books. Experience in the field, explained by experiments in the laboratory, has clearly demonstrated a few principles which underlie the successful and economical use of fertilizers.

Soils vary greatly in their capabilities of supplying food to crops. Different ingredients are deficient in different soils. The way to learn what materials are proper in a given case is by observation and experiment. The rational method for determining what ingredients of plant-food a soil fails to furnish in abundance, and how these lacking materials can be most economically supplied, is to put the questions to the soil with different fertilizing materials and get the reply in the crops produced. How to make these experiments is explained in Circular No. 8 of the Office of Experiment Stations of the U. S. Department of Agriculture. A copy of this circular can be had by applying to the Secretary of Agriculture, Washington, D. C., or to the Maine Agricultural Experiment Station.

The chief use of fertilizers is to supply plant-food. It is good farming to make the most of the natural resources of the soil and of the manures produced on the farm, and to depend upon artificial fertilizers only to furnish what more is needed. It is not good economy to pay high prices for materials which the soil may itself yield, but it is good economy to supply the lacking ones in the cheapest way. The rule in the purchase of costly commercial fertilizers should be to select those that supply, in the best forms and at the lowest cost, the plant-food which the crop needs and the soil fails to furnish.

Plants differ widely with respect to their capacities for gathering their food from soil and air; hence the proper fertilizer in a given case depends upon the crop as well as upon the soil. The fertility of the soil would remain practically unchanged if all the ingredients removed in the various farm products were restored to the land. This may be accomplished by feeding the crops grown on the farm to animals, carefully saving the manure and returning it to the soil. If it is practicable to pursue a system of

stock feeding in which those products of the farm which are comparatively poor in fertilizing constituents are exchanged in the market for feeding stuffs of high fertilizing value, the loss of soil fertility may be reduced to a minimum or there may be an actual gain in fertility.

## Constituents of Fertilizers.

The only ingredients of plant-food which we ordinarily need to consider in fertilizers are potash, lime, sulphuric acid, phosphoric acid, and nitrogen. The available supply of sulphuric acid and lime is often insufficient; hence one reason for the good effect so often observed from the application of lime, and of plaster, which is a compound of lime and sulphuric acid. The remaining substances, nitrogen, phosphoric acid and potash, are the most important ingredients of our common commercial fertilizers, because of both their scarcity in the soil and their high cost. It is in supplying these that phosphates, bone manures, potash salts, guano, nitrate of soda, and most other commercial fertilizers are chiefly useful.

The term "form" as applied to a fertilizing constituent has reference to its combination or association with other constituents, which may be useful, though not necessarily so. The form of the constituent, too, has an important bearing upon its availability, and hence upon its usefulness as plant food. Many materials containing the essential elements are practically worthless as sources of plant food because the form is not right; the plants are unable to extract them from their combinations; they are "unavailable." In many of these materials the forms may be changed by proper treatment, in which case they become valuable not because the element itself is changed, but because it then exists in such form as readily to feed the plant.

*Nitrogen* is the most expensive of the three essential fertilizing elements. It exists in three dstinct forms, organic matter, ammonia and nitrate.

*Organic nitrogen* exists in combination with other elements either as vegetable or animal matter. All materials containing organic nitrogen are valuable in proportion to their rapidity of decay, because change of form must take place before the nitrogen can serve as food. Organic nitrogen differs in availability not only according to the kind of material which supplies it, but

upon the treatment it receives. The nitrogen in the tables of analyses marked "insoluble in water" is organic nitrogen.

*Nitrogen as ammonia* usually exists in commercial manures in the form of sulphate of ammonia and is more readily available than organic nitrogen. While nitrogen in the form of ammonia is extremely soluble in water, it is not readily removed from the soil by leaching, as it is held by the organic compounds of the soil.

*Nitrogen as nitrate* exists in commercial products chiefly as nitrate of soda. Nitrogen in this form is directly and immediately available, no further changes being necessary. It is completely soluble in water, and diffuses readily throughout the soil. It differs from the ammonia compounds in forming no insoluble compounds with soil constituents and may be lost by leaching. The "Nitrogen soluble in water" of the tables includes both the nitrogen as ammonia and as nitrate.

*Phosphoric acid* is derived from materials called phosphates, in which it may exist in combination with lime, iron, or alumina as phosphates of lime, iron, or alumina. Phosphate of lime is the form most largely used as a source of phosphoric acid. Phosphoric acid occurs in fertilizers in three forms: That soluble in water and readily taken up by plants; that insoluble in water, but still readily used by plants, also known as "reverted;" and that soluble only in strong acids and consequently very slowly used by the plant. The "soluble" and "reverted" together constitute the "available" phosphoric acid. The phosphoric acid in natural or untreated phosphates is insoluble in water, and not readily available to plants. If it is combined with organic substance, as in animal bone, the rate of decay is more rapid than if with purely mineral substances. The insoluble phosphates may be converted into soluble forms by treatment with strong acids. Such products are known as acid phosphates or superphosphates. The "insoluble phosphoric acid" of a high cost commercial fertilizer has little or no value to the purchaser because at the usual rate of application the quantity is too small to make any perceptible effect upon the crop, and because its presence in the fertilizer excludes an equal amount of more needful and valuable constituents.

*Potash* in commercial fertilizers exists chiefly as muriates and sulphates. With potash the form does not exert so great an

influence upon availability as is the case with nitrogen and phosphoric acid. All forms are freely soluble in water, and are believed to be nearly if not quite equally available as food. The form of the potash has an important influence upon the quality of certain crops. For example, the results of experiments seem to indicate that the quality of tobacco, potatoes, and certain other crops is unfavorably influenced by the use of muriate of potash, while the same crops show a superior quality if materials free from chlorides have been used as the source of potash.

## Valuation of Fertilizers.

The agricultural value of any of the fertilizing constituents is measured by the value of the increase of the crop produced by its use, and is, of course, a variable factor, depending upon the availability of the constituent, and the value of the crop produced. The form of the materials used must be carefully considered in the use of manures. Slow-acting materials can not be expected to give profitable returns upon quick growing crops, nor expensive materials profitable returns when used for crops of relatively low value.

The agricultural value is distinct from what is termed "commercial value," or cost in market. This value is determined by market and trade conditions, as cost of production of the crude material, methods of manipulation required, etc. Since there is no strict relation between agricultural and commercial or market value, it may happen that an element in its most available form, and under ordinary conditions of high agricultural value, costs less in market than the same element in less available forms and of a lower agricultural value. The commercial value has reference to the material as an article of commerce, hence commercial ratings of various fertilizers have reference to their relative cost and are used largely as a means by which the different materials may be compared.

The commercial valuation of a fertilizer consists in calculating the retail trade-value or cash-cost at freight centers (in raw material of good quality) of an amount of nitrogen, phosphoric acid and potash equal to that contained in one ton of the fertilizer. Plaster, lime, stable manure and nearly all of the less expensive fertilizers have variable prices, which bear no close relation to their chemical composition, but guanos, superphos-

phates and similar articles, for which $20 to $45 per ton are paid, depend for their trade value exclusively on the substances, nitrogen, phosphoric acid and potash, which are comparatively costly and steady in price. The trade-value per pound of these ingredients is reckoned from the current market prices of the standard articles which furnish them to commerce. The consumer, in estimating the reasonable price to pay for high-grade fertilizers, should add to the trade-value of the above named ingredients a suitable margin for the expenses of manufacture, etc., and for the convenience or other advantage incidental to their use.

The trade values for 1902 have not yet been agreed upon, but if any one wishes to calculate the valuation he can do so by using the prices adopted for 1901 by the experiment stations of Connecticut, Massachusetts, Rhode Island and New Jersey. It represents the retail prices at which these ingredients could then be purchased in the various forms mentioned. On account of the greater distance from the large markets, the prices for Maine would probably be a little higher than those quoted.

For many years this Station has not printed an estimate of the commercial value of the different brands licensed in the State.

TRADE VALUES OF FERTILIZING INGREDIENTS FOR 1901.

| | Cents per lb. |
|---|---|
| Nitrogen in ammonia salts | 16½ |
| nitrates | 14 |
| Organic nitrogen in dry and fine ground fish, meat and blood and in mixed fertilizers | 16 |
| in fine bone and tankage | 16 |
| in coarser bone and tankage | 12 |
| Phosphoric acid, water-soluble | 5 |
| citrate-soluble | 4½ |
| of dry, fine ground fish, bone and tankage | 4 |
| of coarser bone and tankage | 3 |
| of fine ground fish, cottonseed meal, castor pomace and wood ashes | 4 |
| of mixed fertilizers, insoluble in ammonium citrate | 2 |
| Potash as high-grade sulphate and in forms free from muriate (or chlorides) | 5 |
| as muriate | 4¼ |

The commercial valuation will be accurate enough as a means of comparison if the following rule is adopted:

Multiply 3.3 by the percentage of nitrogen.

Multiply 1.0 by the percentage of available phosphoric acid.

Multiply 0.4 by the percentage of insoluble phosphoric acid.

Multiply 1.0 by the percentage of potash.

The sum of these four products will be the commercial valuation per ton on the basis taken.

Illustration. The table of analyses shows a certain fertilizer to have the following composition: Nitrogen 2.00%; Available phosphoric acid 8.50%; Insoluble phosphoric acid, 3.50%; Potash 3.25%. The valuation in this case will be computed thus:

| | | |
|---|---|---|
| Nitrogen, | 3.3×2.00, | 6.60 |
| Available phosphoric acid, | 1.0×8.50, | 8.50 |
| Insoluble phosphoric acid, | 0.4×3.50, | 1.40 |
| Potash, | 1.0×3.25, | 3.25 |
| Valuation per ton, | | $19.75 |

Since this rule assumes all the nitrogen to be organic and all the potash to be in the form of the sulphate, it is evident that the valuations thus calculated must not be taken as the only guide in the choice of a fertilizer. At best the valuations can only serve to show the approximate cost of the several ingredients contained in the fertilizer in question. In every case the farmer should consider the needs of his soil before he begins to consider the cost. In many instances a little careful experimenting will show him that materials containing either nitrogen, potash or phosphoric acid alone will serve his purpose as fully as a "complete fertilizer," in which he must pay for all three constituents, whether needed or not.

The results of the analysis of the manufacturer's samples of fertilizers are given on the following pages.

## DESCRIPTIVE LIST OF MANUFACTURERS' SAMPLES, 1902.

| Station number. | Manufacturer, place of business and brand. |
|---|---|
| | THE AMERICAN AGRICULTURAL CHEM. CO., NEW YORK, N. Y. |
| 2112 | Bradley's Complete Manure for Potatoes and Vegetables |
| 2807 | Bradley's Complete Manure with 10% Potash |
| 2321 | Bradley's Corn Phosphate |
| 2111 | Bradley's Eureka Fertilizer |
| 2322 | Bradley's Niagara Phosphate |
| 2323 | Bradley's Potato Fertilizer |
| 2324 | Bradley's Potato Manure |
| 2325 | Bradley's X. L. Superphosphate of Lime |
| 2326 | Clark's Cove Bay State Fertilizer |
| 2327 | Clark's Cove Bay State Fertilizer, G. G |
| 1219 | Clark's Cove Bay State Fertilizer for Seeding Down |
| 2390 | Clark's Cove Defiance Complete Manure |
| 2565 | Clark's Cove Great Planet Manure, A. A |
| 2328 | Clark's Cove King Philip Alkaline Guano |
| 2778 | Clark's Cove Potato Fertilizer |
| 2779 | Clark's Cove Potato Manure |
| 1607 | Cleveland Fertilizer for All Crops |
| 2780 | Cleveland High Grade Complete Manure |
| 2529 | Cleveland Potato Phosphate |
| 2109 | Cleveland Seeding Down Fertilizer |
| 2330 | Cleveland Superphosphate |
| 2331 | "Crocker's" Corn Phosphate |
| 2332 | "Crocker's" Grass and Oats |
| 2333 | "Crocker's" New Rival Ammoniated Superphosphate |
| 2566 | "Crocker's" Potato Hop and Tobacco |
| 2795 | "Crocker's" Special Potato Manure. |
| 2335 | "Crocker's" Superior |
| 2567 | Cumberland Guano for All Crops |
| 2336 | Cumberland Potato Fertilizer. |
| 1385 | Cumberland Seeding Down Manure |
| 2337 | Cumberland Superphosphate |
| 2377 | Darling's Blood, Bone and Potash |
| 1230 | "Great Eastern" General. |
| 1231 | "Great Eastern" Grass and Oats |
| 2395 | "Great Eastern" High Grade Special Potato Manure |
| 2384 | "Great Eastern" Northern Corn Special |
| 2568 | "Great Eastern" Potato Manure. |
| 2781 | High Grade Fertilizer with 10% Potash |
| 2369 | Otis' Potato Fertilizer |
| 2380 | Otis' Seeding Down Fertilizer |
| 2368 | Otis' Superphosphate. |
| 2782 | Pacific Dissolved Bone and Potash |
| 2338 | Pacific Grass and Grain Fertilizer |
| 2569 | Pacific High Grade General Fertilizer |

ANALYSES OF MANUFACTURERS' SAMPLES, 1902.

| Station number. | Nitrogen. | | | | Phosphoric Acid. | | | | | | | Potash. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soluble in water. | Insoluble in water. | Total. | | Soluble. | Reverted. | Insoluble. | Available. | | Total. | | Found. | Guaranteed. |
| | | | Found. | Guaranteed. | | | | Found. | Guaranteed. | Found. | Guaranteed. | | |
| | % | % | % | % | % | % | % | % | % | % | % | % | % |
| 2112 | 1.06 | 2.40 | 3.46 | 3.30 | 5.36 | 3.32 | 1.51 | 8.68 | 8.00 | 10.19 | 9.00 | 6.91 | 7.00 |
| 2807 | 1.99 | 1.31 | 3.30 | 3.30 | 3.59 | 3.19 | 2.44 | 6.78 | 6.00 | 9.22 | 7.00 | 11.20 | 10.00 |
| 2321 | 0.66 | 1.42 | 2.08 | 2.06 | 7.05 | 2.55 | 2.56 | 9.60 | 8.00 | 12.16 | 10.00 | 2.01 | 1.50 |
| 2111 | 0.11 | 1.06 | 1.17 | 1.03 | 5.93 | 2.35 | 1.55 | 8.28 | 8.00 | 9.83 | 10.00 | 2.32 | 2.00 |
| 2322 | 0.40 | 0.64 | 1.04 | 0.82 | 5.41 | 3.15 | 1.38 | 8.56 | 7.00 | 9.94 | 8.00 | 1.49 | 1.00 |
| 2323 | 0.77 | 1.22 | 1.99 | 2.06 | 5.74 | 4.74 | 2.54 | 10.48 | 8.00 | 13.02 | 10.00 | 3.17 | 3.00 |
| 2324 | 0.81 | 1.58 | 2.39 | 2.50 | 2.89 | 3.80 | 3.18 | 6.69 | 6.00 | 9.87 | 8.00 | 5.15 | 5.00 |
| 2325 | 1.10 | 1.36 | 2.46 | 2.50 | 6.74 | 3.16 | 1.80 | 9.90 | 9.00 | 11.70 | 11.00 | 2.68 | 2.00 |
| 2326 | 1.14 | 1.32 | 2.46 | 2.50 | 7.26 | 3.08 | 1.80 | 10.34 | 9.00 | 12.14 | 11.00 | 2.35 | 2.00 |
| 2327 | 0.62 | 1.40 | 2.02 | 2.06 | 7.21 | 2.42 | 2.36 | 2.63 | 8.00 | 11.99 | 10.00 | 1.95 | 1.50 |
| 1219 | ..... | ..... | 2.33 | 1.03 | 7.18 | 2.55 | 1.89 | 9.73 | 8.00 | 11.62 | 10.00 | 2.59 | 2.00 |
| 2390 | 0.40 | 0.68 | 1.08 | 0.82 | 5.24 | 2.74 | 1.48 | 7.98 | 7.00 | 9.46 | 8.00 | 1.59 | 1.00 |
| 2565 | 1.88 | 1.52 | 3.40 | 3.30 | 5.20 | 3.01 | 1.96 | 8.21 | 8.00 | 10.17 | 9.00 | 7.43 | 7.00 |
| 2328 | 0.43 | 0.68 | 1.11 | 1.03 | 5.71 | 2.67 | 1.47 | 8.38 | 8.00 | 9.85 | 10.00 | 2.12 | 2.00 |
| 2778 | 0.91 | 1.03 | 1.94 | 2.06 | 6.49 | 5.31 | 0.40 | 11.80 | 8.00 | 12.20 | 10.00 | 3.35 | 3.00 |
| 2779 | 0.56 | 2.11 | 2.67 | 2.50 | 3.96 | 3.03 | 3.49 | 6.99 | 6.00 | 10.48 | 8.00 | 5.59 | 5.00 |
| 1607 | ..... | ..... | 1.48 | 1.03 | 6.71 | 2.16 | 2.35 | 8.87 | 8.00 | 11.22 | 10.00 | 2.42 | 2.00 |
| 2780 | 2.02 | 1.21 | 3.23 | 3.30 | 4.96 | 3.41 | 2.27 | 8.37 | 8.00 | 10.64 | 9.00 | 7.53 | 7.00 |
| 2329 | 0.62 | 1.34 | 1.96 | 2.06 | 5.95 | 3.99 | 2.74 | 9.94 | 8.00 | 12.68 | 10.00 | 3.03 | 3.00 |
| 2109 | 0.11 | 1.06 | 1.17 | 1.03 | 5.79 | 2.89 | 1.27 | 8.68 | 8.00 | 9.95 | 10.00 | 2.20 | 2.00 |
| 2330 | 0.66 | 1.40 | 2.06 | 2.06 | 7.17 | 2.35 | 2.62 | 9.52 | 8.00 | 12.14 | 10.00 | 2.03 | 1.50 |
| 2331 | 0.26 | 2.06 | 2.32 | 2.06 | 4.52 | 3.65 | 3.87 | 8.17 | 8.00 | 12.04 | . | 2.26 | 1.50 |
| 2332 | ..... | ..... | ..... | ..... | 7.54 | 4.28 | 1.79 | 11.82 | 11.00 | 13.61 | ..... | 2.03 | 2.00 |
| 2333 | 0.23 | 1.14 | 1.37 | 1.03 | 4.82 | 3.70 | 2.47 | 8.52 | 8.00 | 10.99 | ..... | 2.12 | 2.00 |
| 2566 | 1.10 | 1.10 | 2.20 | 2.06 | 5.98 | 2.07 | 2.68 | 8.05 | 8.00 | 10.73 | ..... | 3.34 | 3.00 |
| 2795 | 2.01 | 1.30 | 3.31 | 3.29 | 3.84 | 3.29 | 2.34 | 7.13 | 6.00 | 9.47 | ..... | 10.80 | 10.00 |
| 2335 | 0.10 | 0.96 | 1.06 | 0.82 | 5.19 | 3.87 | 2.11 | 9.06 | 8.00 | 11.17 | .... | 2.12 | 2.00 |
| 2567 | 0.03 | 1.23 | 1.26 | 1.03 | 6.22 | 3.00 | 2.49 | 9.22 | 8.00 | 11.71 | 10.00 | 2.28 | 2.00 |
| 2336 | 0.72 | 1.34 | 2.06 | 2.06 | 6.13 | 4.17 | 2.32 | 10.30 | 8.00 | 12.63 | 10.00 | 3.38 | 3.00 |
| 1395 | ..... | .... | 1.10 | 1.03 | 5.82 | 1.98 | 2.11 | 7.80 | 8.00 | 9.91 | 10.00 | 2.93 | 2.00 |
| 2337 | 0.56 | 1.38 | 1.94 | 2.06 | 7.01 | 2.38 | 2.55 | 9.39 | 8.00 | 11 94 | 10.00 | 2.35 | 1.50 |
| 2377 | .. . | 4.21 | 4.21 | 4.10 | 6.47 | 1.27 | 0.26 | 7.74 | 7.00 | 8.00 | 8.00 | 9.01 | 7.00 |
| 1230 | ..... | ..... | 1.10 | 0.82 | 0.69 | 9.25 | 2.26 | 9.94 | 8.00 | 12.20 | ..... | 4.72 | 4.00 |
| 1231 | ..... | ..... | ..... | ..... | 4.11 | 6.88 | 4.08 | 10.99 | 11.00 | 15.07 | .... | 2.15 | 2.00 |
| 2395 | 2.38 | 1.00 | 3.28 | 3.29 | 4.87 | 3.25 | 1.86 | 8.12 | 6.00 | 9.98 | ..... | 10.64 | 10.00 |
| 2384 | 0.42 | 1.84 | 2.26 | 2.06 | 5.02 | 4.60 | 2.35 | 9.62 | 8.00 | 11.98 | ..... | 2.26 | 1.50 |
| 2568 | 0.85 | 1.23 | 2.08 | 2.06 | 5.92 | 2.31 | 2.76 | 8.23 | 8.00 | 10.99 | ... . | 3.37 | 3.00 |
| 2781 | 1.50 | 1.03 | 2.53 | 2.40 | 5.82 | 1.76 | 2.63 | 7.58 | 6.00 | 10.21 | 7.00 | 10.44 | 10.00 |
| 2369 | 0.77 | 1.22 | 1.99 | 2.06 | 5.68 | 5.03 | 2.42 | 10.71 | 8.00 | 13.13 | 10.00 | 3.20 | 3.00 |
| 2380 | 0.49 | 0.62 | 1.11 | 1.03 | 5.46 | 2.89 | 1.35 | 8.35 | 8.00 | 9.70 | 10.00 | 1.56 | 2.00 |
| 2368 | 0.68 | 1.38 | 2.06 | 2.06 | 6.94 | 2.92 | 2.43 | 9.86 | 8.00 | 12.29 | 10.00 | 2.16 | 1.50 |
| 2782 | ..... | ..... | ..... | ..... | 5.98 | 4.81 | 1.91 | 10.79 | 10.00 | 12.70 | 12.00 | 2.43 | 2.00 |
| 2338 | 0.42 | 0.64 | 1.06 | 0.82 | 5.46 | 3.01 | 1.43 | 8.47 | 7.00 | 9.90 | 8.00 | 2.99 | 1.00 |
| 2569 | 2.13 | 1.41 | 3.54 | 3.30 | 5.15 | 2.92 | 2.14 | 8.07 | 8.00 | 10.21 | 9.00 | 7.18 | 7.00 |

## DESCRIPTIVE LIST OF STATION SAMPLES, 1902.

| Station number. | Manufacturer, place of business and brand. |
|---|---|
| 2339 | Pacific Nobsque Guano. |
| 2340 | Pacific Potato Special |
| 2342 | "Packers Union" Animal Corn Fertilizer |
| 2343 | "Packers Union" Economical Vegetable Guano. |
| 2571 | "Packers Union" Gardeners Complete Manure |
| 2344 | "Packers Union" Potato Manure |
| 2345 | "Packers Union" Universal Fertilizer |
| 1619 | "Packers Union" Wheat, Oats and Clover Fertilizer |
| 2393 | Quinnipiac Climax Phosphate for All Crops |
| 2347 | Quinnipiac Corn Manure. |
| 2572 | Quinnipiac Market Garden Manure. |
| 2573 | Quinnipiac Mohawk Fertilizer |
| 2349 | Quinnipiac Potato Manure. |
| 2350 | Quinnipiac Potato Phosphate |
| 2351 | Quinnipiac Seeding Down Manure |
| 2783 | Read's Farmers' Friend |
| 2352 | Read's Potato Manure |
| 1396 | Read's Practical Potato Special |
| 1397 | Read's Standard Superphosphate |
| 2354 | Read's Sure Catch Fertilizer. |
| 2355 | Read's Vegetable and Vine Fertilizer |
| 2341 | Soluble Pacific Guano |
| 1414 | Standard A Brand. |
| 2574 | Standard Bone and Potash. |
| 2394 | Standard Complete Manure |
| 2361 | Standard Fertilizer. |
| 2362 | Standard Guano for All Crops |
| 2363 | Standard Special for Potatoes |
| 2364 | Williams and Clark's Americus Ammoniated Bone Superphosphate |
| 2365 | Williams and Clark's Americus Corn Phosphate |
| 2576 | Williams and Clark's Americus High Grade Special |
| 2366 | Williams and Clark's Americus Potato Manure |
| 2375 | Williams and Clark's Americus with 10% Potash |
| 1236 | Williams and Clark's Royal Bone Phosphate for All Crops |
| | THE BOWKER FERTILIZER CO., BOSTON, MASS. |
| 2579 | Bowker's Corn Phosphate |
| 2580 | Bowker's Early Potato Manure |
| 2581 | Bowker's Farm and Garden Phosphate |
| 2582 | Bowker's Hill and Drill Phosphate |
| 2584 | Bowker's Potash Bone |
| 2585 | Bowker's Potash or Staple Phosphate |
| 2586 | Bowker's Potato and Vegetable Fertilizer |
| 2587 | Bowker's Potato and Vegetable Phosphate. |
| 2588 | Bowker's Six Per Cent Fertilizer |
| 2589 | Bowker's Square Brand Bone and Potash |
| 2590 | Bowker's Sure Crop Phosphate |
| 2591 | Bowker's Ten Per Cent Manure. |

## ANALYSES OF MANUFACTURERS' SAMPLES, 1902.

| Station number. | Nitrogen. | | | | Phosphoric Acid. | | | | | | | Potash. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total. | | | | | Available. | | Total. | | | |
| | Soluble in water. | Insoluble in water. | Found. | Guaranteed. | Soluble. | Reverted. | Insoluble. | Found. | Guaranteed. | Found. | Guaranteed. | Found. | Guaranteed. |
| | % | % | % | % | % | % | % | % | % | % | % | % | % |
| 2339 | 0.40 | 0.66 | 1.06 | 1.03 | 5.52 | 2.66 | 1.63 | 8.18 | 8.00 | 9.81 | 10.00 | 1.97 | 2.00 |
| 2340 | 0.76 | 1.34 | 2.10 | 2.06 | 5.69 | 4.27 | 2.70 | 9.96 | 8.00 | 12.66 | 10.00 | 3.15 | 3.00 |
| 2342 | 0.31 | 2.10 | 2.41 | 2.47 | 5.64 | 3.22 | 3.46 | 8.86 | 9.00 | 12.32 | ..... | 1.91 | 2.00 |
| 2343 | 0.26 | 1.47 | 1.68 | 1.25 | 4.65 | 2.55 | 2.15 | 7.20 | 6.00 | 9.35 | ..... | 3.59 | 3.00 |
| 2571 | 1.38 | 1.16 | 2.54 | 2.47 | 5.58 | 0.47 | 2.06 | 6.05 | 6.00 | 8.11 | .. .. | 10.99 | 10.00 |
| 2344 | 0.96 | 1.10 | 2.06 | 2.06 | 4.85 | 3.16 | 1.85 | 8.01 | 8.00 | 9.86 | ..... | 6.54 | 6.00 |
| 2345 | 0.25 | 0.96 | 1.21 | 0.82 | 6.05 | 3.22 | 1.46 | 9.27 | 8.00 | 10.73 | ..... | 5.04 | 4.00 |
| 1619 | ..... | ..... | ..... | ..... | ..... | ..... | 1.20 | 10.92 | 11.00 | 12.12 | ... | 2.39 | 2.00 |
| 2393 | 0.39 | 1.06 | 1.45 | 1.03 | 5.10 | 3.54 | 1.63 | 8.64 | 8.00 | 10.27 | 10.00 | 2.91 | 2.00 |
| 2347 | 0.67 | 1.38 | 2.05 | 2.06 | 6.69 | 2.63 | 2.41 | 9.32 | 8.00 | 11.73 | 10.00 | 1.95 | 1.50 |
| 2572 | 2.19 | 1.39 | 3.58 | 3.30 | 4.23 | 4.67 | 1.47 | 8.90 | 8.00 | 10.37 | 9.00 | 7.57 | 7.00 |
| 2573 | 0.03 | 0.83 | 0.86 | 0.82 | 2.60 | 4.87 | 3.86 | 7.47 | 7.00 | 11.33 | 8.00 | 1.58 | 1.00 |
| 2349 | 1.03 | 1.50 | 2.53 | 2.50 | 2.55 | 4.03 | 3.06 | 6.58 | 6.00 | 9.64 | 8.00 | 5.15 | 5.00 |
| 2350 | 0.74 | 1.30 | 2.04 | 2.06 | 5.61 | 4.71 | 2.36 | 10.32 | 8.00 | 12.68 | 10.00 | 3.34 | 3.00 |
| 2351 | 0.39 | 0.64 | 1.03 | 1.03 | 5.44 | 3.14 | 1.46 | 8.85 | 8.00 | 10.04 | 10.00 | 2.61 | 2.00 |
| 2783 | 0.81 | 1.05 | 1.86 | 2.06 | 6.41 | 2.92 | 2.49 | 9 33 | 8.00 | 11.82 | 10.00 | 3.33 | 3.00 |
| 2352 | 0.42 | 2.28 | 2.70 | 2.40 | 4.59 | 1.89 | 1.25 | 6.48 | 6.00 | 7.73 | 7.00 | 10.94 | 10.00 |
| 1396 | ..... | ..... | 1.20 | 0.82 | 3.39 | 1.55 | 0.54 | 4.94 | 4.00 | 5.48 | 5.00 | 8.35 | 8.00 |
| 1397 | ..... | ..... | 1.15 | 0.82 | 6.50 | 1.73 | 0.92 | 8.23 | 8.00 | 9.15 | 10.00 | 4.33 | 4.00 |
| 2354 | ..... | ..... | | ..... | 4.46 | 5.17 | 1.58 | 9.81 | 10.00 | 11.39 | 12.00 | 1.91 | 2.00 |
| 2355 | 0.32 | 1.80 | 2.12 | 2.06 | 5.94 | 2.25 | 1.38 | 8.29 | 8.00 | 9.67 | 10.00 | 6.35 | 6.00 |
| 2341 | 0.52 | 1.46 | 1.98 | 2.06 | 6.72 | 2.72 | 2.32 | 9.44 | 8.00 | 11.76 | 10.00 | 1.91 | 1.50 |
| 1414 | ..... | ..... | 1.33 | 0.82 | 4.84 | 3.08 | 1.96 | 7.92 | 7.00 | 9.8? | 8.00 | 1.71 | 1.00 |
| 2574 | ..... | ..... | ..... | ..... | 7.66 | 2.60 | 1.96 | 10.26 | 10.00 | 12.22 | 12.00 | 2.08 | 2.00 |
| 2384 | 2.40 | 0.90 | 3.30 | 3.30 | 7.02 | 1.99 | 1.04 | 8.81 | 8.06 | 9.85 | 9.00 | 7.56 | 7.00 |
| 2361 | 0.60 | 1.42 | 2.02 | 2.06 | 6.82 | 2.43 | 2.55 | 9.25 | 8.00 | 11.80 | 10.00 | 2.01 | 1.50 |
| 2362 | 0.37 | 0.70 | 1.07 | 1.03 | 5.31 | 3.03 | 1.44 | 8.34 | 8.00 | 9.74 | 10.00 | 2.10 | 2.00 |
| 2363 | 0.82 | 1.20 | 2.02 | 2.06 | 5.65 | 5.16 | 2 40 | 10.81 | 8.00 | 13.21 | 10.00 | 2.93 | 3.00 |
| 2364 | 0.95 | 1.32 | 2.27 | 2.50 | 6.72 | 3.08 | 1.94 | 9.80 | 9.00 | 11.74 | 11.00 | 2.35 | 2.00 |
| 2365 | 0.56 | 1.42 | 1.98 | 2.06 | 6.75 | 2.85 | 2.29 | 9.60 | 8.00 | 11.89 | 10.00 | 1.95 | 1.50 |
| 2576 | 2.15 | 1.39 | 3.54 | 3.30 | 3.80 | 4.10 | 2.15 | 7.90 | 8.00 | 10.05 | 9.00 | 7.48 | 7.00 |
| 2366 | 0.64 | 1.32 | 1.96 | 2.06 | 5.52 | 4.89 | 2.23 | 10.41 | 8.00 | 12.64 | 10.00 | 3.03 | 3.00 |
| 2575 | 0.96 | 1.18 | 2.14 | 2.40 | 4.18 | 2.29 | 1.67 | 6.47 | 6.00 | 8.14 | 7.00 | 10.02 | 10.00 |
| 1236 | ..... | ..... | 1.26 | 1.03 | 6.20 | 3.11 | 2.23 | 9.30 | 8.00 | 11.54 | 10.00 | 2.26 | 2.00 |
| 2579 | 0.40 | 1.14 | 1.54 | 1.50 | 2.27 | 5.90 | 2.19 | 8.17 | 8.00 | 10.36 | 10.00 | 2.52 | 2.00 |
| 2580 | 1.19 | 1.95 | 3.14 | 3.00 | 3.57 | 3.49 | 2.23 | 7.06 | 7.00 | 9.29 | 9.00 | 7.33 | 7.00 |
| 2581 | 0.52 | 1.16 | 1.68 | 1.50 | 2.30 | 6.62 | 2.50 | 8.92 | 8.00 | 11.42 | 10.00 | 2.80 | 2.00 |
| 2582 | 0.71 | 1.73 | 2.44 | 2.25 | 3.27 | 5.48 | 2.76 | 8.75 | 9.00 | 11.51 | 11.00 | 2.16 | 2.00 |
| 2584 | 0.90 | ..... | 0.90 | 0.75 | 3.05 | 1.93 | 3.03 | 4.98 | 6.00 | 8 01 | 8.00 | 2.10 | 2.00 |
| 2585 | 0.18 | 0.74 | 0.92 | 0.75 | 1.69 | 6.43 | 2.15 | 8.12 | 8.00 | 10.27 | 10.00 | 3.37 | 3.00 |
| 2586 | 0.61 | 1.73 | 2.34 | 2.25 | 7.26 | 2.32 | 0.83 | 9.58 | 9.00 | 10.41 | 10.00 | 4.30 | 4.00 |
| 2587 | 0.30 | 1.18 | 1.48 | 1.50 | 2.28 | 6.79 | 2.31 | 9.07 | 9.00 | 11.38 | 11.00 | 2.32 | 2.00 |
| 2588 | 0.35 | 0.65 | 1.00 | 0.75 | 1.39 | 4.82 | 3.05 | 6.21 | 6.00 | 9.26 | 9.00 | 6.48 | 6.00 |
| 2589 | 1.03 | 0.81 | 1.84 | 1.50 | 1.04 | 3.68 | 7.10 | 4.72 | 6.00 | 11.82 | 12.00 | 2.34 | 2.00 |
| 2590 | ..... | 0.78 | 0.78 | 0.75 | 3.16 | 6.12 | 2.31 | 9.28 | 9.00 | 11.59 | 11.00 | 2.36 | 2.00 |
| 2591 | 0.17 | 0.69 | 0.86 | 0.75 | 1.29 | 3.92 | 1.99 | 5.21 | 5.00 | 7.20 | 7.00 | 10.34 | 10.00 |

## DESCRIPTIVE LIST OF MANUFACTURER'S SAMPLES, 1902.

| Station number. | Manufacturer, place of business and brand. |
|---|---|
| 2592 | Gloucester Fish and Potash |
| 2593 | Stockbridge Corn and Grain Manure. |
| 2594 | Stockbridge Potato Manure |
| 2595 | Stockbridge Seeding Down Manure |
| | C. C. CLARK & SON, MT. EPHRAIM, N. J. |
| 2784 | Clark's High Grade Potato Manure. |
| | E. FRANK COE CO., NEW YORK CITY, N. Y. |
| 2806 | E. Frank Coe's Celebrated Special Potato Fertilizer |
| 2797 | E. Frank Coe's Columbian Bone Superphosphate. |
| 2796 | E Frank Coe's Columbian Corn Fertilizer. |
| 2798 | E. Frank Coe's Columbian Potato Fertilizer |
| 2799 | E. Frank Coe's Excelsior Potato Fertilizer. |
| 2805 | E. Frank Coe's Grass and Grain Special |
| 2800 | E. Frank Coe's High Grade Ammoniated Bone Superphosphate |
| 2801 | E. Frank Coe's High Grade Potato Fertilizer. |
| 2802 | E. Frank Coe's New Englander Corn Fertilizer |
| 2803 | E. Frank Coe's New Englander Potato Fertilizer |
| 2808 | E. Frank Coe's Prize Brand Grain and Grass Fertilizer. |
| 2804 | E. Frank Coe's Red Brand Excelsior Guano |
| | DEERING PACKING CO., SACO, ME. |
| 2785 | Perfection Fertilizer |
| | FERNALD, KEENE & TRUE CO., WEST POLAND, ME. |
| 2809 | Fernald, Keene & True's Sweet Corn Manure |
| | WALTER G. FOSS, FOXCROFT, ME. |
| 2786 | New Market Fertilizer |
| | LISTER'S AGRICULTURAL CHEMICAL WORKS, NEWARK, N. J. |
| 2614 | Animal Bone and Potash |
| 2610 | High Grade Special for Spring Crops |
| 2787 | Potato Manure |
| 2613 | Seeding Down. |
| 2609 | Special Corn and Potato Fertilizer |
| 2611 | Lister's Success Fertilizer. |
| | LOWELL FERTILIZER CO., BOSTON, MASS. |
| 1874 | Swift's Lowell Animal Brand. |
| 1875 | Swift's Lowell Bone Fertilizer |
| 1876 | Swift's Lowell Dissolved Bone and Potash |
| 2386 | Swift's Lowell Ground Bone. |
| 2387 | Swift's Lowell Potato Manure. |
| 1877 | Swift's Lowell Potato Phosphate |
| | NATIONAL FERTILIZER CO., BRIDGEPORT, CONN. |
| 1885 | Chittenden's Ammoniated Bone |
| 1886 | Chittenden's Complete Fertilizer. |
| 2385 | Chittenden's Market Garden. |
| | NEW ENGLAND FERTILIZER CO., BOSTON, MASS. |
| 2378 | New England Corn Phosphate. |
| 2379 | New England Potato Fertilizer |
| 2788 | New England Seeding Fertilizer. |
| | EDWIN J. PHILBRICK, AUGUSTA, ME. |
| 1888 | Philbrick's Fertilizer. |

## ANALYSES OF MANUFACTURERS' SAMPLES, 1902.

| Station number. | Nitrogen. | | | | Phosphoric acid. | | | | | | | Potash. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total. | | | | | Available. | | Total. | | | |
| | Soluble in water. | Insoluble in water. | Found. | Guaranteed. | Soluble. | Reverted. | Insoluble. | Found. | Guaranteed. | Found. | Guaranteed. | Found. | Guaranteed. |
| | % | % | % | % | % | % | % | % | % | % | % | % | % |
| 2592 | 0.26 | 0.56 | 0.82 | 0.75 | 1.18 | 5.34 | 2.90 | 6.52 | 6.00 | 9.42 | 9.00 | 1.25 | 1.00 |
| 2593 | 1.29 | 1.97 | 3.26 | 3.00 | 3.51 | 1.59 | 2.04 | 8.10 | 7.00 | 10.14 | 9.00 | 7.24 | 7.00 |
| 2594 | 1.32 | 1.88 | 3.20 | 3.00 | 2.57 | 3.54 | 2.27 | 6.11 | 6 00 | 8.38 | 8.00 | 10.34 | 10.00 |
| 2595 | 0.79 | 1.59 | 2.38 | 2.25 | 2.97 | 2.88 | 4.24 | 5.85 | 6.00 | 10.09 | 10.00 | 10.04 | 10.00 |
| 2784 | 2.31 | 1.50 | 3.81 | 3.28 | 5.50 | 3.05 | 1.90 | 8.55 | 7.00 | 10.45 | 8.00 | 7.41 | 5.00 |
| 2806 | 1.26 | 0.62 | 1.88 | 1.65 | 7.34 | 1.19 | 2.71 | 8.53 | 8.00 | 11.24 | 9.50 | 4.73 | 4.00 |
| 2797 | 0.63 | 0.56 | 1.19 | 1.20 | 6.03 | 2.50 | 2.70 | 8.53 | 8.50 | 11.23 | 10.00 | 3.90 | 2.50 |
| 2796 | 0.60 | 0.74 | 1.34 | 1.20 | 7.29 | 2.77 | 2.53 | 9.46 | 8.50 | 12.01 | 10.00 | 2.98 | 2.50 |
| 2798 | 0.54 | 0.80 | 1.34 | 1.20 | 6.30 | 2.16 | 2.49 | 9.46 | 8.50 | 11.95 | 10.00 | 3.08 | 2.50 |
| 2799 | 1.46 | 0.96 | 2.42 | 2.40 | 6.03 | 1.97 | 2.22 | 8.00 | 7.00 | 10.22 | 8.50 | 9.35 | 8.00 |
| 2805 | 0.07 | 0.73 | 0.80 | 0.80 | 6.73 | 2.57 | 2.81 | 9.30 | 8.50 | 12.11 | 10.00 | 2.28 | 1.50 |
| 2800 | 1.02 | 1.06 | 2.08 | 1.85 | 6.76 | 2.26 | 2.30 | 9.02 | 9.00 | 11.32 | 13.00 | 3.09 | 2.25 |
| 2801 | 1.68 | 0.92 | 2.60 | 2.40 | 7.15 | 1.53 | 2.76 | 8.68 | 7.50 | 21.44 | 8.50 | 6.48 | 6.00 |
| 2802 | 0.63 | 0.70 | 1.33 | 0.80 | 7.15 | 2.42 | 2.60 | 9.57 | 7.50 | 12.17 | 9.00 | 3.11 | 3.00 |
| 2803 | 0.37 | 0.66 | 1.03 | 0.80 | 6.09 | 2.36 | 2.78 | 8.45 | 7.50 | 11.23 | 9.00 | 3.28 | 3 00 |
| 2808 | ..... | .... | ..... | ..... | 6.64 | 3.96 | 3.06 | 10.55 | 10.50 | 13.61 | 12.00 | 2.59 | 2.00 |
| 2804 | 2.30 | 2.07 | 3.37 | 3.40 | 7.59 | 2.14 | 1.77 | 9.73 | 9.00 | 11.50 | 10.50 | 6.74 | 6.00 |
| 2785 | 0.52 | 0.40 | 0.92 | 0.40 | 7.27 | 3.61 | 0.72 | 10 88 | 6.00 | 11.60 | 8.00 | 2.86 | 2.00 |
| 2809 | 1.82 | 0.79 | 2.61 | 2.50 | 6.75 | 3.64 | 1.72 | 10.39 | 9.00 | 12.11 | 11.00 | 2.80 | 2.00 |
| 2786 | 0.49 | 0.35 | 0.84 | 0.40 | 7.26 | 3.52 | 0.83 | 10.78 | 6.00 | 11.61 | 8.00 | 2.82 | 2.00 |
| 2614 | ... .. | ..... | ..... | .. .. | 8.01 | 1.61 | 1.53 | 9.62 | 10.00 | 11.15 | 11.00 | 2.34 | 2.00 |
| 2610 | 0.59 | 1.07 | 1.66 | 1.65 | 6.36 | 1.54 | 2.23 | 7.90 | 8.00 | 10.13 | 9.00 | 10.75 | 10.00 |
| 2787 | 1.92 | 1.25 | 3.17 | 3.30 | 5.50 | 2.46 | 3.09 | 7.96 | 8.00 | 11.05 | 9.00 | 7.22 | 7.00 |
| 2613 | 0.28 | 0.78 | 1.06 | 0.83 | 3.88 | 3.34 | 3.03 | 7.22 | 7.00 | 10.25 | 8.00 | 1.25 | 1.00 |
| 2609 | 0.59 | 10.7 | 1.66 | 1.65 | 5.44 | 3.22 | 2.54 | 8.66 | 8.00 | 11.20 | 9.00 | 3.23 | 3.00 |
| 2611 | 0.31 | 0.99 | 1.30 | 1.24 | 6.16 | 3.02 | 2.58 | 9.18 | 9.00 | 11.76 | 11.00 | 2.37 | 2.00 |
| 1874 | ..... | ..... | 2.85 | 2.47 | .... | ..... | 1.01 | 10.38 | 9.00 | 11.39 | 10.00 | 4.10 | 4.00 |
| 1875 | ..... | ..... | 2.06 | 1.65 | ..... | .. ... | 1.31 | 8.27 | 8.00 | 9.58 | 9.00 | 3.56 | 3.00 |
| 1876 | ..... | ..... | 1.90 | 1.65 | ..... | ..... | 1.73 | 9.33 | 9.00 | 11.06 | 10.00 | 2.45 | 2.00 |
| 2386 | ..... | ..... | 2.38 | 2.47 | .. ... | ..... | ..... | ..... | ..... | 27.24 | 25.00 | ..... | ..... |
| 2387 | 0.78 | 0.94 | 1.72 | 1.65 | 3.33 | 4.47 | 1.35 | 7.80 | 7.00 | 9.15 | 8.00 | 4.52 | 4.00 |
| 1877 | ..... | ..... | 2.61 | 2.47 | ..... | ..... | 1.08 | 9.41 | 8.00 | 10.49 | 9.00 | 6.96 | 6.00 |
| 1885 | ..... | ..... | 2.42 | 1.60 | ..... | ..... | 1.61 | 9.72 | 8.00 | 11.33 | 10.00 | 3.69 | 2.00 |
| 1886 | .. .. | ..... | 3.79 | 3.30 | ..... | ..... | 1.33 | 9.35 | 8.00 | 10.68 | 10.00 | 6.31 | 6.00 |
| 2385 | 1.22 | 1.00 | 2.22 | 2.47 | 4.45 | 2.60 | 2.48 | 7.05 | 6.00 | 9.53 | 8.00 | 5.94 | 5.00 |
| 2378 | 0.76 | 1.02 | 1.78 | 1.65 | 3.85 | 4.93 | 1.33 | 8.78 | 8.00 | 10.11 | 9.00 | 3.23 | 3.00 |
| 2379 | 0.88 | 0.88 | 1.76 | 1.64 | 3.46 | 4.89 | 0.98 | 8.35 | 7.00 | 9.33 | 8.00 | 4.28 | 4.00 |
| 2788 | 0.78 | 0.67 | 1.45 | 1.22 | 4.42 | 2.95 | 1.21 | 7.37 | 7.00 | 8.58 | 8.00 | 2.63 | 2.00 |
| 1888 | 0.38 | 1.65 | 2.03 | 2.00 | 2.00 | 5.19 | 1.74 | 7.19 | 7.00 | 8.93 | 9.00 | 5.58 | 5.00 |

## DESCRIPTIVE LIST OF MANUFACTURERS SAMPLES, 1902.

| Station number. | Manufacturer, place of business and brand. |
|---|---|
| | THE PARMENTER & POLSEY FERTILIZER CO., PEABODY, MASS. |
| 2598 | A A Brand Fertilizer |
| 2599 | Grain Grower |
| 2346 | P. & P. Potato Fertilizer |
| 2123 | Plymouth Rock Brand Fertilizer |
| 2124 | Special Potato Fertilizer. |
| 2125 | Star Brand Superphosphate |
| | PORTLAND RENDERING CO., PORTLAND, ME. |
| 2776 | Bone Tankage |
| | PROVINCIAL CHEMICAL FERTILIZER CO., LIMITED, ST. JOHN, N. B. |
| 2560 | Potato Phosphate. |
| | RUSSIA CEMENT CO., GLOUCESTER, MASS. |
| 2600 | Essex A 1 Superphosphate |
| 2601 | Essex Complete Manure for Corn, Grain and Grass |
| 1411 | Essex Complete Manure for Potatoes, Roots and Vegetables |
| 2106 | Essex Corn Fertilizer |
| 2602 | Essex Market Garden and Potato Manure |
| 1568 | Essex XXX Fish and Potash |
| | SAGADAHOC FERTILIZER CO., BOWDOINHAM, ME. |
| 2789 | Aroostook Potato Manure |
| 2790 | Clark's Mixture |
| 2791 | Dirigo Fertilizer |
| 2792 | Sagadahoc High Grade Superphosphate |
| 2793 | Special Potato Fertilizer |
| 2794 | Yankee Fertilizer. |
| | JOHN WATSON, HOULTON, ME. |
| 2608 | Watson's Improved High Grade Potato Manure |

NOTE—While this Bulletin was in press the Bowker Fertilizer Company applied for licenses for the Maine State Grange Potato Manure with the following guaranteed analysis: Nitrogen, 1.50 per cent; available phosphoric acid, 9 per cent; total phosphoric acid, 12 per cent; potash, 12 per cent; and Maine State Grange Chemicals with a guaranteed analysis of nitrogen, 2 5 per cent; available phosphoric acid, 8 per cent; total phosphoric acid, 12 per cent; potash, 4 per cent.

The Sagadahoc Fertilizer Company have also applied for license for Special Clover Fertilizer with a guaranteed analysis of available phosphoric acid, 6 per cent; total phosphoric acid, 9 per cent.

ANALYSES OF MANUFACTURERS' SAMPLES, 1902.

| Station number. | Nitrogen. | | | | Phosphoric Acid. | | | | | | | Potash. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total. | | | | | Available. | | Total. | | | |
| | Soluble in water. | Insoluble in water. | Found. | Guaranteed. | Soluble. | Reverted. | Insoluble. | Found. | Guaranteed. | Found. | Guaranteed. | Found. | Guaranteed. |
| | % | % | % | % | % | % | % | % | % | % | % | % | % |
| 2598 | 3.14 | 1.52 | 4.66 | 4.53 | 3.59 | 4.04 | 2.03 | 7.63 | 7.00 | 9.66 | 8.00 | 8.12 | 8.00 |
| 2599 | 0.59 | 0.61 | 1.20 | 0.82 | 3.30 | 4.45 | 4.32 | 7.75 | 7.00 | 12.07 | 8.00 | 2.70 | 2.00 |
| 2346 | 1.00 | 0.84 | 1.84 | 1.64 | 2.36 | 5.15 | 0.99 | 7.51 | 6.00 | 8.50 | 7.00 | 6.91 | 6.00 |
| 2123 | 0.21 | 2.08 | 2.29 | 2.47 | 3.81 | 4.21 | 1.38 | 8.02 | 8.00 | 9.40 | 9.00 | 4.19 | 4.00 |
| 2124 | 1.69 | 1.29 | 2.98 | 3.29 | 4.21 | 4.27 | 1 29 | 8.48 | 8.00 | 9.77 | 9.00 | 7.41 | 7.00 |
| 2125 | 1.01 | 0.79 | 1.80 | 1.64 | 3.80 | 3.54 | 1.15 | 7.34 | 7.00 | 8.49 | 8.00 | 2.60 | 2.50 |
| 2776 | 2.69 | 3.43 | 6.12 | 6.00 | ..... | ..... | 4.85 | 9.57 | ..... | 14.42 | 14.00 | ..... | ..... |
| 2560 | ..... | ..... | 3.46 | 3.09 | 6.81 | 1.44 | 6.68 | 8.25 | 8.00 | 14.93 | 14.00 | 7.20 | 6.50 |
| 2600 | 0.18 | 1.34 | 1.52 | 1.00 | 1.96 | 5.32 | 4.93 | 7.29 | 7.00 | 12.22 | 9.00 | 2.11 | 2.00 |
| 2601 | 0.97 | 2.91 | 3.88 | 3.30 | 5.90 | 3.75 | 1.50 | 9.65 | 7.00 | 11.15 | 9.50 | 9.36 | 9.50 |
| 1411 | ..... | ... .. | 3.96 | 3.70 | 2.60 | 5.54 | 2.84 | 8.14 | 7.00 | 10.98 | 9.00 | 9.18 | 8.50 |
| 2106 | 0.52 | 1.72 | 2.24 | 2.00 | 5.31 | 4.03 | 4.14 | 9.34 | 8.50 | 13.48 | 10.50 | 3.33 | 3.00 |
| 2602 | 0.79 | 1.55 | 2.34 | 2.00 | 5.25 | 5.17 | 2.65 | 10.42 | 8.00 | 13.07 | 10.00 | 5 06 | 5.00 |
| 1568 | .... | ..... | 2.68 | 2.10 | 8.00 | 2.63 | 2.56 | 10.63 | 9.00 | 13.19 | 12.00 | 2.75 | 2.25 |
| 2789 | 0.68 | 0.55 | 1.23 | 1.50 | 5.41 | 2.89 | 1.05 | 8.30 | 7.00 | 9.35 | 8.00 | 4.36 | 3.00 |
| 2790 | 6.35 | 1.29 | 7.64 | 7.50 | 0.19 | 6.51 | 2.52 | 6.70 | 2.00 | 9.22 | 8.00 | 8.94 | 8.00 |
| 2791 | 0.35 | 0.81 | 1.16 | 1.50 | 2.63 | 4.63 | 5.66 | 7.26 | 5.00 | 12.92 | 12.00 | 4.66 | 1.75 |
| 2792 | 1.04 | 1.01 | 2.05 | 2.00 | 4.21 | 4.13 | 1.79 | 8.34 | 7.00 | 10.13 | 8.00 | 5.16 | 3.00 |
| 2793 | 1.83 | 0.67 | 2.50 | 2.25 | 4.15 | 3.43 | 0.89 | 7.58 | 8.00 | 8.47 | 9.00 | 8.75 | 7.50 |
| 2794 | 0.35 | 0.41 | 0.76 | 0.40 | 7.30 | 2.73 | 1.04 | 10.03 | 6.00 | 11.07 | 8.00 | 3.05 | 2.00 |
| 2608 | 1.56 | 1.86 | 3.42 | 3.00 | 3.19 | 3.26 | 4.19 | 6.45 | 6.00 | 10.64 | 7.00 | 5.18 | 5.00 |

## THE CHIEF PROVISIONS OF THE FERTILIZER LAW APPLYING TO MANUFACTURERS, IMPORTERS AND DEALERS.

The law for the regulation of the sale and analyses of commercial fertilizers makes the following requirements upon manufacturers, importers or dealers who propose to sell or offer for sale commercial fertilizers in the State:

1. *The Brand.* Each package shall bear, conspicuously printed, the following statements:

The number of net pounds contained in each package.
The name or trade mark under which it is sold.
The name of the manufacturer or shipper.
The place of manufacture.
The place of business of manufacturer or shipper.
The percentage of nitrogen or its equivalent in ammonia.
The percentage of potash soluble in water.
The percentage of phosphoric acid in available form.
The percentage of total phosphoric acid.

2. *The Certificate.* There shall be filed annually between Nov. 15 and Dec. 15 with the Director of the Station a certificate containing an accurate statement of the brand. This certificate applies to the next succeeding calendar year. (Blanks for this purpose will be furnished on application to the Station.)

3. *Manufacturer's Samples.* There shall be deposited annually, unless excused by the Director under certain conditions, a sample of fertilizer, with an accompanying affidavit that this sample "corresponds within reasonable limits to the fertilizer which it represents."

4. *Analysis fee.* For each brand of fertilizer sold or offered for sale in the state there shall be paid annually to the Director of the Station "an analysis fee as follows: Ten dollars for the phosphoric acid and five dollars each for the nitrogen and potash, contained or said to be contained in the fertilizer."

5. *The license.* Upon receipt of the fee, the certificate and the sample (if required), the Director of the Station "shall issue a certificate of compliance."

[The full text of the law will be sent to those asking for it.]

CHAS. D. WOODS, *Director.*

# ORCHARD NOTES.

W. M. MUNSON.

As noted in previous reports of the Experiment Station, there have been several attempts to disseminate certain varieties of fruit which should prove hardy in some of the more trying localities, and to encourage the cultivation of fruit for home use and for market throughout the State. Although Maine is pre-eminently suited to apple growing, there is a very general neglect of this most important fruit.

In 1889 cions of the most promising varieties of apples were sent to leading orchardists in various parts of the State for the purpose of studying the adaptability of these varieties to the different conditions. The following year fifty-four Russian varieties were obtained from Professor Budd of the Iowa Agricultural College, and were sent to parties in Rangeley, Houlton, and northern Aroostook with the understanding that written reports were to be returned from time to time. With few exceptions these reports have been very meager and unsatisfactory. A personal examination of the trees has been made, however, and notes upon their condition and value made from time to time.

In 1891, and for two or three years following, a special effort was made to introduce some of the newer fruits mentioned into the northern part of Aroostook county, where, until the advent of the Oldenburg and the Wealthy, all attempts at apple culture had failed. In accordance with this plan arrangements were made with Mr. James Nutting of Perham to test such varieties as might be sent him and report upon the same each year. Until the death of Mr. Nutting, in 1894, this plan was carried out and promising results were obtained.—See Annual Report 1891, p. 97; 1892, p. 90. The writer has made several visits to the orchard and recorded the behavior of the several varieties. At the Station orchard duplicates of most of the varieties obtained

have been grown for purposes of study and for dissemination if thought desirable. The present report is based upon the observations made in the several localities.

## HARDY APPLES IN MAINE.

As above noted, the Experiment Station has since 1890 had under observation several apples of Russian origin, and other varieties originating either in the colder parts of Maine or in the northwest. All of these varieties are hardy and most of them are productive. Very few of them, however, are worthy of general dissemination in those parts of Maine where the well known varieties of English and American origin will thrive. In the northern part of the State some of them are valuable and some are worthy of culture under any conditions. The accompanying table gives a concise description and estimate of the value of the several varieties tested, both for the northern counties and for the general apple growing sections of the State. The most promising sorts are treated more in detail.

The widely varying conditions existing in different parts of Maine render a general statement as to the value of any given variety only approximately correct. Some varieties which are considered specially valuable in Aroostook county are unknown in the southern counties; while others, which are of merit for the south, are not sufficiently hardy for the northern portion. In the accompanying list separate columns are assigned for the value of each variety in the northern and southern parts of the State. The first column marked "north" includes Aroostook, and the northern parts of Piscataquis, Somerset, Penobscot and Washington counties. The column marked "south" includes Oxford, Kennebec, Waldo and all of the southern counties. The numbers in parentheses are the importation numbers of Prof. Budd.

The value of any given variety is indicated thus: Two stars (**) indicate a variety of special merit, one to be recommended for general culture. One star (*) shows that the variety is worthy of cultivation, though not of superior merit. A dagger (†) indicates a variety not fully tested in the region designated. A dash (—) shows that the variety has been tried and is not considered worthy.

The abbreviations used in characterizing the several varieties are fully explained below. As an example of their interpretation

take the Alexander. As will be seen, the variety is described as a large, striped apple of roundish-conical form and moderately good quality in season during the autumn. It is of Russian origin and is worthy of general planting.

### CATALOGUE OF THE HARDIEST APPLES.

*Abbreviations used.*—Size—l, large; m, medium; s, small. Form—c, conical; ob oblate; r, roundish. Color—g, green; r, red; g y, greenish-yellow; y r, yellow and red; r s, red striped; rus, russetted. Flavor—a, acid; s a, sub-acid; s, sweet. Flesh—b, breaking; d, dry; j, juicy; c, crisp; t, tough. Season—E A, early autumn; L A, late autumn; W, winter.

| Variety. | Description. | | | | | | | Value. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Size. | Form. | Color. | Flavor. | Flesh. | Season. | Origin. | North. | South. | |
| Alexander..... | l | r c | g r | a | j | A | Rus. | ** | * | A popular market sort. |
| Anisim (18m) ..... | s | c | r | a | j | A | Rus. | ** | * | Of the Jonathan type, very productive. |
| Aport (252) ..... | l | c | g r | a | j | A | Rus. | ** | * | Of Alexander type. |
| Arabka (257)..... | m | r c | g r | a | d | W | Rus. | * | — | Dry, insipid, but very handsome, resembling Blue Pearmain. |
| Arctic..... ..... | m | r c | y r | s a | c j | W | N. Y. | ** | * | "A hardy Baldwin." |
| Arthur ..... ..... | s | r c | g r | a | j | W | N. Y. | † | .... | Very hardy, promising north. |
| Bethel ..... | m | r | r s | a | c j | W | Vt. | * | * | Promising for the north. |
| Borsdorf (356) ..... | s | r ob | y | s a | c | W | Rus. | * | * | Small but hardy, productive, and keeps well. |
| Cross (413)..... ... | m | r c | r s | a | j | A | Rus. | * | — | Good for cooking. |
| Daisy ..... .... | m | r c | y r | a | c j | LA | Rus. | † | † | Handsome, promising. |
| Duchess No. 8 ..... | m | r c | r s | a | c j | L A | Minn. | † | † | Promising seedling of Oldenburg. |
| Dudley. .... ..... | l | r ob | r y | a | b j | EW | Me. | ** | * | Widely planted in northern Maine. |
| Early Scarlet..... | m | r c | r | a | c j | EA | Can. | ** | † | Good. Of Astrachan type. |
| Early Sweet . . . . | m | c | y | j | s | EA | Rus. | † | † | |
| Excelsior... ..... | m | ob c | r g | a | c j | A | Minn. | † | † | Scabs badly. |
| Gideon..... | m | r ob | y r | a | j | A | Minn. | .... | — | Rots at core. |
| Gideon No. 6..... | m | c | y r | a | c j | A | Minn. | † | .... | A large handsome crab; seedling of Gideon. |
| Golden Reinette .. | m | c | y r | a | j | A | Rus. | † | ... | Promising. |
| Green Crimean (589) | l | c | g | a | j | A | Rus. | * | — | Good for cooking. |
| Harry Kaump.... | s | r ob | y | a | d | W | Eu. | † | † | Small, hardy, good keeper. |
| Hayford Sweet.... | m | c | g r | s | c | W | Me. | ** | ... | "The best sweet apple for the north." |
| Hibernal (378)..... | l | ob c | r s | a | c j | A | Rus. | * | * | Good for cooking. |

CATALOGUE OF THE HARDIEST APPLES—CONTINUED.

| Variety. | Description. | | | | | | | Value. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Size. | Form. | Color. | Flavor. | Flesh. | Season. | Origin. | North. | South. | |
| Iowa Blush..... | m | c | y r | a | c | W | Ia. | † | ... | |
| Koursk Anis .. ... | . | ..... | ... | ... | ... | ..... | ..... | † | .... | |
| Koursk Reinette (20M) | l | ob c | g | a | c | LA | Rus. | † | † | Good for cooking. |
| Lead (3M) ..... | l | ob c | g r | a | c j | A | Rus. | † | † | Good for cooking. |
| Longfield (161) ... | m | c | y r | a | c j | LA | Rus. | * | * | A profuse annual bearer of good quality. |
| Losouka (4Orel) .. | m | c | r s | a | j | A | Rus. | † | — | Drops badly. |
| Malinda ..... | m | c | g r | a | j | W | Minn. | † | .... | |
| Malett ..... | m | ob c | g r | a | j | A | Rus. | † | † | |
| McMahon ..... | l | ob c | y r | a | c j | A | Wis. | † | .... | Large, handsome, promising north. |
| N. W. Greening ... | l | c | g | a | t j | W | ... .... | * | * | Handsome, prolific; a late keeper. |
| North Star ..... | m | c | y r | a | c | LA | Ia. (?) | † | .... | |
| October .. . .. .... | m | ob | y r | a | j | EA | Minn. | † | † | One of Gideon's crab seedlings. |
| Okobena. ..... | m | ob c | r s | a | b j | LA | ..... | † | ... | Promising north. |
| Oldenburg .... .... | l | ob | r s | a | b j | EA | Ger. | ** | * | The standard autumn variety, north. |
| Ostrakoff (4M) .... | m | ob | r s | a | j | W | Rus. | † | .... | Promising north. |
| Patten's Greening | m | c | g | a | c j | EW | Ia. | † | .... | Seedling of Oldenburg. |
| Peter..... | m | c | g r | a | j | A | Minn. | .... | † | Very productive; shows crab parentage. |
| Pink Anis ..... | s | c | y r | s a | j | A | Rus. | * | * | Very prolific. |
| Prolific Sweeting. | m | c | y | s | d | A | Rus. | ** | * | The best sweet Russian. |
| Repka Aport (261). | l | r c | g r | a | j | A | Rus. | ** | * | Similar to Alexander. |
| Royal Table (5M). | m | c | y r | a | b j | LA | Rus. | * | .... | Promising for Aroostook. |
| Russian Gravenstein (135M) ..... | m | c | r s | s a | b j | EA | Rus. | * | * | Promising, but drops rather badly. |
| Sandy Glass (24M) | l | c | g | a | j | A | Rus. | † | .... | Drops badly. |
| Saunkernaty ..... | s | c | g | a | j | W | Rus. | .... | — | Small, drops badly, poor quality. |
| Severs ..... .... | m | c | y r | a | b j | EA | ... .... | † | † | Of the Astrachan type. |
| Shiawassee..... | m | ob | r | s a | j | EW | Mich. | ** | ** | Should be more widely planted both north and south, |
| Silken Leaf (75M). | m | c | g r | a | j | EW | Rus. | ... | — | Good for cooking. |
| Sklanka..... | m | c | g y | a | j | A | Rus. | .... | — | Drops badly; of poor quality. |
| Skruischapfel (42 Vor.) ..... .... | s | c | g r | a | c | A | Rus. | .... | — | Small, poor; drops badly. |

CATALOGUE OF THE HARDIEST APPLES—CONCLUDED.

| Variety. | Description. | | | | | | | Value. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Size. | Form. | Color. | Flavor. | Flesh. | Season. | Origin. | North. | South. | |
| Striped Winter.... | l | c | r s | a | j | A | Rus. | .... | .... | Coarse, poor in quality; drops badly. |
| Switzer ..... | m | c | r s | a | j | A | Rus. | † | ... | Poor quality. |
| Table Apple..... | s | r ob | g | a | t | A | Rus. | † | † | |
| Tetofsky..... ... | s | c | r s | a | j | EA | Rus. | * | .... | Too soft and poor in quality. |
| Thompson 26..... | m | c | g y | a | c | W | Minn. | † | † | Hardy seedlings from Jewell Nursery Co., Lake City, Minn. |
| Thompson 29 ..... | .... | ..... | .... | ... | .... | ..... | Minn. | † | † | |
| Thompson 43..... | .. | ..... | ... | .... | ... | ..... | Minn. | † | † | |
| Thompson 24..... | l | c | r s | a | j | A | Minn. | † | † | |
| Tiesenhausen. ... | .. | ..... | .... | .... | .... | ..... | Rus. | .... | — | Small, worthless. |
| Titovka.. ..... . | l | ob c | y r | a | b r | A | Rus. | † | — | Showy but coarse. |
| Titus..... .. .... | l | ob c | r s | a | c j | A | Rus. | † | — | Showy but coarse; drops badly. |
| Vargulek (12M) ... | m | c | r s | a | j | A | Rus. | † | — | Drops badly. |
| 38 Voronesch..... | m | ob c | r s | sa | b j | EA | Rus. | † | — | Similar to Duchess. A little earlier. |
| Wealthy ..... | m | ob c | g r | sa | j | EW | Minn. | ** | ** | A good general purpose sort. |
| Wolf River..... | l | c | r s | a | j | LA | Minn. | † | † | Coarse, showy. |

Attention is again called to the fact that the varieties here named do not constitute a complete list of the hardy apples of Maine but, as stated, only the newer and a few of the well known ironclad sorts are considered. Of the list, those of greatest value are described below.

## MOST VALUABLE RUSSIANS.

Of the fifty or more varieties of Russian apples which have been planted in the Station orchard, very few are worthy of general recommendation for planting in Maine. Most of them, as grown in this section of the State, are autumn varieties which, though exceedingly productive and perfectly hardy, are of inferior quality, keep poorly and drop badly before maturity. Of the list but three—Alexander, Longfield and Yellow Transparent—can be recommended for general culture in competition with apples of American and West European origin, and the number to be advised for the colder sections of the State is not

large. The most promising, in addition to the varieties already named, are Anisim, Arabka, Borsdorf, Cross, Green Crimean, Hibernal, Koursk Reinette, Pink Anis, Prolific Sweeting, Repka Aport, Russian Gravenstein. Many others thrive but, as noted, are inferior. Below is given a condensed description of the varieties named:

*Alexander.* Fruit large, roundish-conical, greenish-yellow, washed and splashed with crimson; calyx large, open, set in a deep often russetted basin, stem short, stout, inserted in a deep cavity. Flesh yellowish, rather coarse grained, juicy, sub-acid. Good. Season, October and November. Tree hardy, vigorous, spreading, productive.

The good form, large size and bright color of this fruit attract attention in any market and it is one of the best of the autumn varieties for the kitchen. The chief objections to it are its short season and the fact that it decays very quickly if even slightly injured. The Alexander is one of a race or family of Russian apples (the *Aport* family) which is represented in the Station orchard by two other varieties—Repka Aport and No. 252.

*Anisim.* Fruit small to medium, roundish-conical, greenish-yellow almost completely overlaid with rich dark crimson; calyx small, in a medium basin; stem slender, in a rather deep cavity. Flesh white, crisp, juicy, sub-acid. Good. Season October to February.

This variety, which has been called the "Jonathan of the North" is very hardy, productive and prolific. Unless the fruit is thinned it is likely to be small.

*Arabka.* Fruit large, oblate-conical, greenish, washed with purple and covered with a dense bloom; calyx large in a moderately deep, slightly corrugated basin; stem medium inserted in a deep cavity. Flesh greenish white, juicy but rather tough, sharp acid and lacking in richness. Season, January to April.

This is a very handsome apple, somewhat resembling Blue Pearmain. It is very hardy, productive, and an excellent keeper for the northern sections, but its quality is inferior.

*Borsdorf.* Fruit small, oblate, yellow, sometimes with blush cheek in the sun; calyx large, open, in broad shallow basin; stem slender, in a medium cavity. Flesh yellowish, firm, juicy, sub-acid. Good. Season, January to April.

But for its rather small size, this variety would be specially good for the colder sections of the State. It is of the Rhode Island Greening type, is of good quality, and an excellent keeper.

*Cross.* Fruit medium, oblate-conical, greenish-yellow washed and splashed with crimson. Flesh white, crisp, juicy, brisk acid. Good for cooking. Season, September to November.

The tree is hardy, vigorous and productive. The fruit, which resembles Haas, is inclined to drop badly, however, and it is not recommended for any except the most trying sections of the State. There is some doubt as to the identity of this variety as growing in the Station orchard.

*Green Crimean.* Fruit large, conical, yellowish-green changing to yellow at maturity; stem medium, cavity deep; calyx open; basin shallow, corrugated. Flesh greenish-white, tender, juicy, acid. Good. Season, October to December.

The tree is vigorous, spreading, hardy, productive. A good autumn variety for cooking.

*Hibernal.* Fruit medium to large, oblate-conical, greenish-yellow washed and splashed with bright red; stem short, stout, inserted in a deep, rather broad, russetted cavity; basin medium, slightly corrugated; calyx open. Flesh yellowish, crisp, tender, juicy, acid; core, small. Good. Season, October to December.

Tree very hardy, of strong, low, spreading habit; vigorous; productive. Although not a dessert apple this variety is valuable for cooking, and on account of its hardiness and productiveness is one of the best of the newer Russian sorts.

*Longfield.* Introduced from Russia in 1870. Fruit medium, roundish-conical, pale yellow with light red cheek; stem slender, inserted in a deep, very narrow, slightly russetted cavity; basin medium, wrinkled; calyx partly open. Flesh white, crisp, very juicy, tender, brisk sub-acid. Good for cooking and dessert. Season, September to January.

The tree is very hardy and productive, and unless the fruit is thinned it is liable to be undersized. In common with most Russian sorts it drops badly, but on account of its good quality, its hardiness and productiveness it is one of the best of its class.

*Pink Anis.* Fruit small to medium, conical, golden washed and splashed with carmine. Flesh yellowish, crisp, very juicy, mildly acid. Good. Season, September to December.

The tree is vigorous, upright, spreading, productive. The fruit drops rather badly, but otherwise it is a good autumn variety. It was received under the name of Golden Reinette and was described under that name in a former report.

*Prolific Sweeting.* Fruit medium, conical, somewhat irregular, pale yellow, usually russetted in the rather deep cavity. Flesh white, crisp, rather dry, sweet. Good. Season, September and October.

This variety, imported in 1870, is the most valuable fall sweet apple for the northern part of the State. It is planted largely in northern Vermont and was regarded very highly by Dr. Hoskins. In size and color it resembles Yellow Transparent.

*Russian Gravenstein.* Fruit medium to large, conical, somewhat angular; greenish-yellow washed, striped and splashed with crimson; stem set in a deep cavity; calyx open, in a broad rather shallow basin. Flesh yellowish, tender, breaking, juicy, subacid. Good for cooking or dessert. Season, September.

The tree is hardy, vigorous, spreading, and productive. It does well in northern Aroostook, but will not supersede the Oldenburg, which it somewhat resembles.

*Yellow Transparent.* Fruit medium, roundish-oblate, slightly conical; clear pale yellow; stalk medium, slender, in a rather large greenish cavity; calyx closed, in a medium, slightly corrugated basin. Flesh white, crisp, tender, juicy, sprightly subacid. Good. Season, August.

This variety is now well known and recognized as a valuable early summer apple suitable for any locality. The principal objection to it is its very delicate color. The slightest bruise is evident.

The reason for discarding most of the Russian apples tested may be summed up in a very few words, Viz.: *Poor quality, early season, habit of dropping before maturity.*

### SOME OTHER GOOD VARIETIES.

Besides the Russian apples, there are many of the older varieties of American origin which are perfectly hardy over a large portion of the State. Some of these are the standard market varieties of central and southern Maine; others, like those men-

tioned below, are valuable but not generally known. The varieties here named are all growing in the Station orchard and are commended only after careful personal observation.

*Arctic.* This variety was fully described in a former report.* It is attracting considerable attention in the State and is worthy of trial where Baldwin will not succeed. It has been characterized as a "hardy Baldwin," though averaging larger than the older variety and being of a milder flavor.

*Boiken.* Fruit large, oblate, rich greenish-yellow overlaid with carmine, sprinkled with numerous white dots. Stem set in deep slightly russetted cavity; calyx large, open, set in a broad, rather deep slightly corrugated basin. Flesh white, crisp, juicy, slightly acid. Good. Season late winter.

The tree is very vigorous, spreading and productive. A promising variety of the Rhode Island Greening type.

*Doctor.* Fruit large, roundish oblate, yellow washed and splashed with red, with numerous grayish dots. Stalk medium, deeply set; calyx large open, set in a wide, slightly corrugated basin. Flesh yellowish, tender, juicy, breaking, aromatic, subacid. Good to very good. November to April.

This variety was sent to the Station by the U. S. Dept. of Agriculture under the name of "Newby," but has since been identified as above. It is a Pennsylvania apple; said to be a rather indifferent grower, but, as top-worked on Alexander, has given excellent results in the Station orchard. The variety is promising for New England.

*Hurlbut.* Though an old variety, this apple is not as well known as its merits deserve. It is hardy, productive, of excellent quality and keeps until late in the spring. March 1 not one of the specimens placed in the cellar had begun to decay.

*Milding.* The Milding† well deserves its reputation as a valuable early winter variety. It is of good size, hardy, productive and is highly prized for family use, and for market where known. The trees are among the best in the Station orchard.

*Munson Sweet.* This old Massachusetts variety is justly popular wherever known, but is not so widely planted as it should be. The tree is vigorous, spreading, and an annual and abundant bearer. Fruit medium oblate, pale yellow, often with

* Rep. Maine Exp. Sta. 1896, 70. † See Rep. Maine Agr'l Exp. Sta. 1896,

a blush. Stem short, inserted in a rather large cavity; calyx closed, basin small. Flesh yellowish, tender, juicy, sweet. Good to very good. September to February.

Of 100 average specimens placed in the cellar October 15, but two showed signs of decay on January 22, and the flavor and texture were still normal. The tree is vigorous, productive and hardy as far north as Perham.

*Northwestern Greening.* Tree vigorous, spreading, hardy. Fruit large, conical, clear yellowish-green sprinkled with lighter dots. Stalk medium, cavity rather deep, russetted; calyx partly open, basin slightly corrugated. Core very large. Flesh greenish-white, coarse grained, juicy but tough, mildly acid. Good. Season, late winter.

*Rolfe.* This variety, which was commended in the previous report,* still thrives and bears well in protected localities in northern Aroostook. It is a valuable sort for family use wherever grown.

*Shiawassee.* Fruit medium, oblate, greenish-white overlaid with crimson, with stripes and splashes of a deeper shade. Flesh firm, white, tender, juicy, brisk sub-acid. Very good. Season October to February.

This seedling of Fameuse, originating in Shiawassee county, Michigan, is larger and altogether finer than its parent. It possesses more character and keeps longer than Fameuse. The tree is vigorous, productive and perfectly hardy as far north as Perham.

*Wealthy.* This variety, which originated with Peter M. Gideon of Excelsior, Minn., from seed said to have been taken from Maine, is too well known to need description; though its full value is not appreciated. It is hardy in northern Aroostook, is of good color, excellent habit and is very productive. It is an autumn variety in southern Maine, but with improved shipping facilities, it may readily be put upon the markets of London and Liverpool where it is always in good demand. Growers too often make the mistake of allowing this variety to overbear and thus produce undersized fruit.

*Westfield.* The old "Seek-no-further," long popular in New York and Michigan, is being more widely planted and better

* Rep. Maine Agr'l Exp. Sta. 1896, 71.

known as a valuable hardy winter apple. It is yielding well in the Station orchard and is hardy in Perham. Its color is not equal to Baldwin, but for family use it is excellent and when known will find a ready market.

*York Imperial.* Many inquiries have been received concerning the York Imperial. As top-worked upon a Russian variety in the Station orchard the tree is hardy, upright, of very vigorous habit, but has only just begun to bear. The few specimens produced the past season have kept well and are of good quality, but the high color for which Maine growers usually look is wanting.

### SOME MAINE SEEDLINGS.

The most valuable fruits for any difficult climate are usually those of local origin or those from regions having similar climatic conditions. While the Russian varieties have wrought a revolution in the possibilities of fruit production in the northwest, we have already seen that comparatively few of them are of special value in Maine. There are, however, many seedlings of local reputation which are worthy the attention of our fruit growers—particularly those who are located in the rich agricultural section of northern Maine. A few of the most important of these are mentioned below and a complete list of Maine seedlings is at present being worked up.

*Aroostook.* "A sweet golden russet of medium size which keeps without any trouble until July 1."

The tree originated about thirty years ago on the farm of Silas S. Stiles, Mapleton, Aroostook county. It has a good local reputation and is worthy of wider dissemination. Its parent was "some kind of a Greening raised in Cumberland county."

*Dudley.* (Dudley's Winter, North Star). A seedling of Oldenburg, grown by J. W. Dudley, Castle Hill, Aroostook county.

Tree very vigorous, spreading, hardy and productive, with large, roundish-oblong, greenish-yellow fruit, washed and splashed with crimson. Stem medium, inserted in a deep cavity; calyx partly open, basin large. Flesh yellowish, crisp, breaking, rather coarse, brisk sub-acid. Good. September to January—later in Aroostook county.

This variety is, perhaps, more widely grown than any other of the newer sorts originating in New England. It is being dis-

seminated by a New York nursery firm under the name "North Star"—an unfortunate circumstance as there is another very different variety bearing that name by right of priority. It is a valuable acquisition as a winter fruit for the northern parts of the State, but as grown at Orono it is decidedly a fall variety.

*Rolfe.* Originated in the town of Guilford about 1820.

Fruit medium to large, oblate, often angular, yellowish, shaded and striped with red. Stalk short, inserted in a large cavity; calyx large, closed, in a rather large, regular basin. Flesh white, fine-grained, tender, juicy, sub-acid; core small. Good to very good. November to January.

Though comparatively an old variety, the Rolfe is not as widely known as it should be. The variety originated on high land in the town of Guilford, about a mile from the Piscataquis river. The seed from which it sprang was brought from Western Maine to that place by a Mr. Rolfe. About 1820 the original tree, together with several other young seedlings was given to Elder Macomber—hence the name *Macomber* applied to this variety by Downing. A sprout from the original tree is still standing on the Macomber farm and produces annual crops of fruit. H. L. Leland of East Sangerville, has more than a hundred trees of this variety in his orchard and says: "The Rolfe in our local markets, sells better and at bigger prices than any other variety that we grow. It sells well as a shipping apple, though not much known." As already noted, the variety is hardy in sheltered locations as far north as Presque Isle, and it is regarded highly wherever known.

*Stowe.* Originated in Perham, Aroostook county, about 1875. Tree vigorous, spreading, very hardy, an annual bearer.

Fruit medium to large, roundish conical, greenish-yellow with blush cheek, and with many small whitish dots. Stem, short slender, inserted in a medium cavity. Flesh yellowish, tender, juicy, sub-acid. Core small. Good. February to May, in Aroostook.

This variety has never attracted the attention of nurserymen, but has had a good local reputation for several years. It is well worthy of general dissemination as a valuable "ironclad" variety. Its history, as given in the report of the Maine Pomological Society for 1895, is essentially as follows: Seed was brought to Perham from Massachusetts by Francis Stowe about 1862, and

the variety in question was one of the resulting seedlings. The tree was isolated in 1875 and has been known locally for several years as Stowe's Winter. Mr. Rufus F. Stowe, son of the originator, writes that "it will keep longer than anything except Ben Davis and is nearly equal to that."

Other hardy local seedlings which are being more or less extensively planted in northern Maine are Hayford Sweet,—regarded as the best winter sweet—Monroe Sweet, and McIntire Sweet. Hayford Sweet is much hardier than Talman and takes the place of that variety as a late keeping sweet apple.

## A SUGGESTION.

The foregoing notes represent pretty nearly the present status of the hardy apples which have been tried in Maine. The multiplicity of varieties may, however, be confusing to some who purpose growing fruit for market. To such the oft repeated advice, "for market plant few varieties," is most strongly urged. Over a large portion of Maine any of the more prominent commercial varieties will thrive, but in those sections where the standard of hardiness is marked by Oldenburg and Wealthy it is well to make a virtue of necessity and for commercial purposes plant only those sorts which have a recognized commercial value or those which are of such conspicuous merit that a market is assured. The varieties named are hardy, productive, attractive and have an established reputation in Boston and in English markets, a fact which assures ready sale for all choice fruit. English buyers are at the present time urging the more extensive planting of Wealthy in southern Maine to supply the demand for fall fruit in London and Liverpool, and will welcome the hundreds of barrels that every year waste for want of local buyers in the northern portion of the State. Really choice Oldenburgs frequently net three dollars (sometimes more) per barrel in Boston, yet every year hundreds of barrels of this fruit lie on the ground and decay. Alexander, also, is always in demand at good prices. The need of fruit growers in northern Mane is not so much new hardy varieties which will compare with Baldwin, Greening and Northern Spy as it is a better appreciation of the merits of the varieties already known to thrive, a better acquaint-

ance with markets and market demands, and more care in cultivating and managing the orchards.

For home use a wider range of varieties is desirable and a selection from the list above mentioned may be made to suit personal preferences. In no case, however, is it wise to plant too freely of untried sorts. Varieties of known value and hardiness may be planted as stocks on which the newer kinds may be top-worked at will.

### THE KEEPING QUALITY OF CERTAIN APPLES.

For the purpose of comparing the keeping qualities of certain varieties of apples growing in the Station orchard, several specimens of each were placed in a cool cellar and were examined from time to time through the winter. A few of the varieties—*viz:* Longfield, Munson Sweet, Sandy Glass, Koursk Reinette, Green Crimean, and Haas were harvested about two weeks before removal to the cellar, and were kept in the potting shed at the greenhouse. The remainder were placed in the cellar after two days. Some of the varieties—notably Golden Russet, Talman and Winesap—were harvested a little too early for the best results and shrivelled badly early in the season.

The following table shows in detail the condition of the several varieties at various times during the winter. A record was kept of the number of specimens of each variety which was worthless at each examination and the number only slightly decayed or "specked." In the table, however, all affected specimens are referred to as decayed.

The fruit was placed in the cellar October 9. Critical examination of all specimens was made as indicated in the table.

| Variety. | Whole number specimens. | Number Decayed. November 18. | December 18. | January 22. | March 1. | March 22. | Remarks. |
|---|---|---|---|---|---|---|---|
| Anisim | 78 | 2 | 4 | 6 | 10 | — | Should be used by Jan. 1. Flavor badly impaired Jan. 22. |
| Arctic | 40 | .... | ... | 1 | 2 | ... | One of the best. In excellent condition at last examination. |
| Bethel | 6 | .... | ... | ... | .. | ... | This variety and the next are firm as when put in the cellar. |
| Bolken | 5 | ... | ... | .... | ... | ... | |
| Borsdorf | 86 | 1 | .... | 8 | 6 | — | Inclined to shrivel. Loses flavor by the last of January. |
| Cross | 48 | 4 | 1 | 3 | 12 | ... | Soft and shrivelled in January. Quality still good. All worthless March 1. |
| Doctor | 75 | 1 | .... | 2 | 4 | 3 | All remaining specimens in excellent condition at close of test. |
| Dudley | 47 | 10 | 7 | 12 | — | — | Should be used by January 1. Flavor lost. |
| Golden Russet | 57 | .... | .... | .... | 1 | 2 | Picked too early. Shrivelled badly early in the season, but retained flavor well. |
| Green Crimean | 44 | 5 | 2 | 22 | — | — | A fall variety; worthless after January 1. |
| Haas | 44 | 5 | 4 | 7 | — | — | A December variety. All very soft when examined in Jan. |
| Harry Kaump | 48 | .... | 2 | .... | 5 | 5 | An excellent keeper, but loses flavor by March 1. |
| Hurlbut | 45 | .... | ... | .. | ... | 9 | One of the best. Begins to break down in March. |
| Koursk Reinette | 45 | 10 | 10 | 14 | — | — | An autumn variety; should be used by December 15. |
| Large Anis | 47 | .... | 2 | 2 | 5 | — | Retains form and color but is mostly soft and worthless after January 15. |
| Lead Apple | 42 | 7 | 3 | 2 | 7 | — | Begins to soften and rot at the core in January. |
| Longfield | 74 | 4 | 1 | 9 | 17 | — | Begins to shrivel and lose flavor in January. |
| Mann | 61 | 1 | 1 | .... | .. | ... | One of the best keepers; not of high quality. |
| Milding | 26 | ... | 1 | .... | 2 | 4 | In excellent condition at close of test. |
| Munson Sweet | 100 | . | .... | 2 | 2 | 3 | Form and flavor still good at close of test. |
| Northwestern Greening | 25 | .... | .... | .... | ... | .... | As firm in texture at close of test as at first. Good. |
| Peter | 39 | .... | 1 | 2 | — | — | Retains form and color well, but is soft and worthless for market after January 1. |
| Pewaukee | 41 | 1 | ... | 5 | 1 | 2 | Begins to shrivel in February. Retains flavor well. |
| Porter | 21 | .. | .... | 3 | 3 | .... | Retains form and texture remarkably well. Begins to lose flavor in January. |
| Rall's Janet | 53 | .... | .... | .... | .... | .... | One of the best keepers. Color is not attractive. |
| Sandy Glass | 41 | 4 | 2 | 6 | — | — | An autumn variety. Soft and worthless after January 1. |
| Shiawassee | 33 | .... | .... | 3 | 4 | 2 | Excellent in form and texture through the season. Begins to lose flavor by February 1. |
| Stark | 44 | .... | ... | ... | ... | .... | Firm and in excellent condition at close of test. |
| Striped Winter | 20 | 5 | 4 | — | — | — | Soft and worthless after Jan. 1. |

| Variety. | Whole number specimens. | Number Decayed. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|
| | | November 19. | December 18. | January 22. | March 1. | March 22. | |
| Talman | 47 | ... | ... | .... | 2 | 1 | Begins to shrivel in March. |
| Thompson No. 24 | 44 | 4 | 9 | 6 | — | — | Limit reached about Jan. 1. |
| Thompson No. 26 | 17 | 1 | 1 | 1 | .... | 2 | Keeps till April but begins to lose flavor by February 1. |
| Thompson No. 34 | 29 | 18 | 4 | — | — | — | An early fall variety. |
| Walbridge | 67 | .... | 1 | .. | 1 | 3 | Keeps well but of poor quality. |
| Westfield | 24 | .. | 1 | .. | ... | 2 | One of the best. |
| Winesap | 62 | .... | . | ... | 1 | 2 | Shrivels some, but retains flavor till spring. |

An examination of the above table reveals some interesting facts concerning the varieties named. Dudley, Haas, and most of the Russian varieties are comparatively poor keepers and should be used before January. Borsdorf, Longfield, Pewaukee, Porter and Shiawassee, are at their best before the first of February, though keeping well into March. Hurlbut, Milding and Munson Sweet, begin to break down in March; the latter is in good condition from October to this date. Arctic, Bethel, Boiken, Mann, Northwestern Greening, Rall's Janet, Stark, Westfield, and Winesap are in prime condition up to April 1. Munson Sweet, Porter and Shiawassee showed most surprising results and indicate that with care these sorts may be kept much longer than is generally supposed. Peter, which became too soft for market in January, made very good pies as late as the end of March.

# THE GRASS THRIPS (*Anaphothrips striata,* Osborn.)

LEWIS R. CARY.

Although the grass thrips is of much and growing economic importance, not only in this State, but in nearly all New England, it has received but little attention in this country, either from the structural or economic standpoint. Only one publication bearing upon the economic importance has been found.*

In 1880 Prof. Herbert Osborn published the description of a species of thrips under the name of *Thrips striata,* which he said caused considerable damage to the grass crop in the eastern states.

In Prof. Comstock's Introduction to the Study of Insects, which appeared in 1882, a species of thrips is described under the name of *Limothrips poaphagus.* This was reported as doing great damage to the early maturing grasses, especially June grass, *Poa pratensis.* Specimens of both of these forms sent to the Bureau of Entomology of the Department of Agriculture for identification were referred to the genus *Anaphothrips.* The specific name *striata,* given by Prof. Osborn, was retained on account of priority.

Before the question of the scientific name of the insect had been finally settled, it was the common custom to speak of it as the "grass thrips," and that name is still commonly applied to it except in strictly scientific writings.

## DESCRIPTION.

A large proportion of the mature insects are females. They vary in length from one millimeter to one and one-half millimeters and are of two forms, winged and wingless. Both forms are comparatively long and slender and taper toward each end from the region of the thorax.

* Fernald and Hinds. The Grass Thrips. Treatment for Thrips in Greenhouses. Bul. 67, May, 1900. Hatch Exp. Sta., Mass. Agr. College.

The winged forms are larger than the wingless ones, brown in color, and have two pairs of long slender wings, each of which is reduced to a narrow piece, having two or three short veins, and bearing on its edges two rows of fine hairs, fig. 6, hw and fw. The hairs are placed so that the upper row on each wing crosses the lower row at an acute angle and, when the wings are extended, the hairs on the posterior edge of the fore wing overlap those on the anterior edge of the hind wing. This gives practically the same resistance as if the wings were entire. When the wings are folded they lie along the dorsal wall of the abdomen, nearly its entire length, with the anterior above the posterior pair. Their extremities are bent so that the ends of the wings on each side of the body turn away from each other.

In the wingless forms the wings may be entirely wanting, or they may be represented by small protuberances, fig. 5, wp. This form is light pink in color, and is covered with a thin soft integument. The head is small and tapers toward its anterior end. It bears two small compound eyes and three ocelli. The antennæ are placed on the extreme anterior part of the head, very near to the median line. They are about .2 m m. in length, and each is made up of eight joints. The basal joint is short and stout. The next three joints are flask shaped, the anterior enlarged end of each surrounding the neck of the succeeding joint. The fifth joint is smaller than any of the preceding. The sixth, seventh and eighth joints are fused into one long piece, the sixth being much the longest of these three joints. At the anterior end of each joint, around the rim of the cup, there is a row of rather short stiff spines. There are also a variable number of spines scattered over the surfaces of the several joints.

The mouth is situated on the ventral side of the head and, on account of the arrangement of the mouth parts, is placed so far posteriorly that it opens at a point posterior to the junction of the head and prothorax, fig. 14, mp.

The prothorax, figs. 6 and 14, is short, a little wider than the head, and nearly square in outline as viewed from the dorsal side. The ventral is very much shorter than the dorsal surface, as the head extends farther posteriorly on the ventral than on the dorsal surface, (see fig. 14). It bears along its sides a number of spines, and a few very short spines are scattered over the dorsal surface.

The mesothorax, figs. 6 and 14, msth, is, in the adult, about twice as long as either of the other thoracic somites. In the larva and pupa it is not proportionately so long. It is shaped like a barrel, except that it is thinner dorsoventrally at its anterior end. In the winged form it bears the wings, and in the wingless forms it is either smooth or bears the rudimentary wings. In the former its dorsal surface is broken up into a number of plates which allow for the movement of the wings.

The metathorax, figs. 6 and 14, mtth, is narrow in front and broadens out behind to join the abdomen. On its dorsal surface it has the appearance of being an abdominal rather than a thoracic somite.

Each of the three thoracic somites bears a pair of legs that have the usual number of joints. All of the joints, except the coxa and tarsus, are flattened laterally, fig. 16. The tarsus has at its extremity, in place of the usual claws, a bladder shaped organ, fig. 16, at the sides of which there are two small rudimentary organs that many entomologists interpret as being tarsal claws. The bladder is supposed to represent modified pulvilli.

The anterior pair of legs are quite short and stout, and are attached near the anterior part of the somite. The second pair of legs are somewhat longer and are attached to the posterior part of their somite. The third pair of legs are much the longest and slimmest of the three pairs. They are attached to the anterior part of the somite.

The abdomen is made up of eight somites. It tapers gradually from before backward, the last somite being quite slender. The first five somites are nearly alike in shape. The sixth somite is wedge shaped with its broad end placed on the dorsal surface and its edge on the ventral surface, fig. 14.

The ovipositor is attached at the junction of the sixth and seventh abdominal somites and when not in use fits into a small groove on the ventral surfaces of the seventh and eighth somites. It is made up of four valves, fig. 14, ovp, which are united so as to leave a groove on the dorsal surface, down which the eggs pass at the time of oviposition. The three angles of the ovipositor are sharply serrate, so that it will hold, while being worked into the tissues of the plant.

The males of this species, fig. 3, are not very frequently found, and it is thought that the majority of the females lay partheno-

genetic eggs. The males are not as slender as the females, and they differ from them somewhat in the position and shape of parts. The eyes are placed more dorsally. The prothorax is large, and has a pair of large spines at its posterior angle on each side. The mesothorax is short, and as seen from the dorsal surface, is nearly round in outline. The small metathorax has its line of junction with the mesothorax semicircular, and its posterior outline straight. The abdomen is quite narrow in front and grows gradually wider posteriorly as far as the fourth somite. From this point it tapers gradually to the posterior end of the body. The last somite is modified to form the male copulatory apparatus. This somite bears two pairs of large, long spines.

## LIFE HISTORY.

The adult insects pass the winter months in the dead vegetation at the bases of their host plants, very close to or on the ground, where they are protected by the debris. In the spring as soon as the weather has become sufficiently warm to start the grass, they come out from their winter quarters and begin to lay eggs in the tender leaves of the young grass. The eggs are deposited in the tissues of the blades near their upper surfaces. Fernald and Hind * determined by keeping insects in captivity that each female is capable of laying from fifty to sixty eggs. The first eggs laid hatch in from twelve to fifteen days. Later in the season the time required is materially reduced. In the hot dry periods of the summer they may hatch in a week.

When the larvæ are hatched they seek some sheltered place in which to pass the next stages of their development. At this period of their development they are most frequently found in the sheaths of the blades, especially those of the young stalks, near the ground. In the later stages they sometimes congregate in the upper sheaths of the stem, and then they cause the "silver top," which is the most conspicuous evidence of their work.

The larvae, especially in the later stages, are quite active, running about the leaves inside of the sheath or even on the head, among the flowers. The pupal stage is passed in some quiet place, as at the base of the sheath of some lower leaf. In this stage the insect takes no food and moves only very sluggishly.

* The Grass Thrips. Bul. 67, May, 1900. Hatch Exp. Sta., Mass. Agr. College.

In the early spring months a large proportion of the females produced are of the winged form. They fly about and infest new fields, so that in a very short time a large area may become badly infested with the insects. As the season advances the number of the winged forms becomes less, until in the latter part of the season, September or October, there are very few of the winged form, among all those produced.

### LARVA.

The larva, fig. 1, resembles the adult in shape and color but is smaller. Compared with the adult, the head of the larva is small, the antennae short, and there is not as much difference in the size and shape of the thoracic somites. There are very few spines on the body, a tuft on each of the last two abdominal somites being the only conspicuous ones.

### PUPA.

The pupa, fig. 2, (last larval stage) has a very distinctive appearance. It is encased in an external covering, probably the last moulting case, which disguises the form of the insect to a great extent. The head is about the same shape as in the larva. The antennæ are bent back so that they lie upon the dorsal surface of the head and prothorax, and their covering shows neither joints or spines. The prothorax is shaped like that of the adult. The mesothorax is long and bears on its dorsal surface a pair of wing cases, which in the pupæ of the winged forms extend posteriorly nearly the length of the abdomen. In the pupæ of the wingless forms the wing cases are very short.

### MOUTH PARTS.

*Fig. 4.*

The mouth parts of the Thysanoptera differ very much from those of the other orders of insects. They have, in part, the characteristics of the biting insects, and in part, those of the sucking forms. If we accept the old interpretation, and consider the piercing setæ mandibles, the typical mouth parts are all represented and are not much fused.

The labrum is triangular in shape, but quite unsymmetrical. It is longer on the right than on the left side, the greater part of the attachment of the base of the labrum being on the right side of the median line of the head.

The parts which have been described by most American writers as mandibles are slender bristle-like spines, each of which has an enlargement at its upper end. They are situated inside of the mouth, and when in use extend through the oral aperture. Sections of the head clearly show, as has been mentioned by Garman,* that the upper broad end of these parts are joined to the maxillæ by a short round basal piece. There is a distinct joint between these two parts.

The maxillæ are elongated, triangular in shape, and placed so that they form the lateral borders of the mouth. Near their middle point there is a three-jointed palp.

The labrum is made up of two thickened portions which lie at the side of the mouth below the maxillæ, and a third ventral portion connecting the thickened parts. It bears on its lower third a pair of three-jointed palps. The palps bear spines on the distal end of each joint.

On the left side of the head there is a single unpaired organ, shaped somewhat like one of the piercing setæ, only it is stouter and has the upper portion much thicker. There is nothing on the right side of the head to correspond to this organ except, in some cases a small papilla.

Inasmuch as the piercing setæ are composed of two portions united by a joint, they are not homologous with the mandibles of other Hexopoda, which are in all cases composed of a single piece. They should rather be regarded as specialized lobes of the maxillæ.

The unpaired organ has been interpreted by some writers as an epipharynx which has been shifted to one side. Others consider it to be the left mandible, the right mandible being wanting or rudimentary.

Considering the modification of the parts, and the apparent deficiency of the right side of the head, it would seem that the latter is the most reasonable interpretation.

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* Garman, H.—The assymetry of the Mouth-parts of the Thysanoptera, American Naturalist, Vol. XXX, July, 1896.

## DIGESTIVE SYSTEM AND ACCESSORY GLANDS.

*Fig. 7.*

The alimentary canal is small and short. It is only about one and one-half times the length of the body.

The mouth is little more than a narrow tube through which the setæ project. At its upper end it widens out and joins the pharynx, which runs anteriorly for a short distance, then turns sharply back, and joins the œsophagus. The œsophagus is very narrow and has an exceedingly small lumen. It passes backward over the anterior end of the first thoracic ganglion, and runs back to the middle of the mesothorax, where it joins the mid-intestine.

The mid-intestine is the longest part of the canal. It is separated by three constrictions into four divisions. The first and second divisions of the mid-intestines are of about equal length and together they extend from the mesothorax to the fifth abdominal somite, where they join the third division. At this point there is a sharp turn and the third division runs anteriorly as far as the anterior part of the third abdominal somite. Here, again, there is another turn, and the fourth division runs posteriorly as far as the sixth abdominal somite, where it joins the hind-intestine. At this point the malpighian tubules enter the intestine.

The hind-intestine is small and somewhat convoluted. It shows no division into ileum and colon. At the posterior end it is enlarged to form the rectum.

The mouth and pharynx have a chitinous lining which is quite thick. The anterior part of the œsophagus also has a thin, flexible, chitinous lining. The outer walls of the œsophagus are very thin and delicate and have very few muscle fibers.

The walls of the mid-intestine are much thicker, and are composed of several layers. On the inside is the lining membrane, the cuticula. Just outside of this, with their apices projecting into the lumen of the intestine, is a layer of large pyramidal epithelial cells. These cells are imbedded in a basement membrane of connective tissue, outside of which there are two layers of muscle fibers, one circular and the other longitudinal. Outside of these there is a thin membranous covering.

The epithelial cells in the first two divisions of the mid-intestine are especially active as secreting cells. Part of them are filled with granules that are suspended in the protoplasm of the cell, and others are quite free from these granules. In the posterior divisions of the mid-intestine the epithelial cells are not so large or high, but the arrangement of tissues is the same.

In the hind-intestine the cuticula is very thick and the epithelial cells are small and rather flat. The three inner layers of the hind-intestine are thrown up into folds which are not very noticeable in the anterior part, but are larger in the posterior part. In the rectum the folds are very large and form the so-called rectal glands. On the outside, in the depressions between these ridges, there are six bands of longitudinal muscle fibers. The rectum is larger than the rest of the hind-intestine, and has thick muscular walls. The rectal glands probably have no function as glands but are thought to be of use in closing the intestine.

### SALIVARY GLANDS.

The salivary glands, fig. 7, sg, are two in number. They are situated in the dorsal region of the anterior part of the mesothorax, just in front of the anterior end of the mid-intestine, and dorsal to the œsophagus. The glands are ovate in shape and at their anterior ends give rise to a pair of small ducts which soon unite to form a single median duct. This runs forward, just dorsal to the œsophagus, and opens into the mouth near the oral aperture. The glands are made up of a small number of large cells, which are imbedded in a basement membrane of connective tissue. The cells have large prominent nuclei, and may be seen in different stages of secretion. Some are filled with granules and others have the cell contents free from granules. The lumen of the gland is small and irregular.

The fluid secreted by these glands would seem, from the position of the opening of the duct, to have little digestive function, but rather to serve as a lubricant for the mouth parts.

### EXCRETORY SYSTEM.

The excretory apparatus consists of four large malpighian tubules, fig. 7, mt, which open into the intestine at the junction of the mid- and hind-intestine and extend as far anteriorly as

the first abdominal somite. They lie in the abdomen without any definite arrangement, occupying the spaces between the other organs and are richly supplied with tracheæ.

Each tubule is composed of large cells with prominent nuclei, that are so placed that they give it a spiral appearance. A transverse section shows from five to seven cells around the lumen of the tubule.

## MUSCULAR SYSTEM.

*Fig. 8.*

The muscular system corresponds in its general arrangement to the segmented structure of the body; that is, most of the muscles are arranged inter-segmentally. The typical arrangement is shown in any of the anterior abdominal somites. When a transverse section is taken across one of these somites, fig. 13, four longitudinal rows, each composed of five muscles, are seen. The four rows are placed so that there are two on the dorsal and two on the ventral side.

The ends of these muscles are attached by a sort of tendon to the infolding of the integument between each two somites. In the last abdominal somite the posterior ends of the longitudinal muscles are attached to ridges in the integument. These muscles are bellied so that they are thicker in the middle than at the ends, and each is nearly square in cross section. The longitudinal muscles of the abdomen are all arranged on this plan. By this arrangement one end of the muscles of two somites being attached at practically the same point, it is possible to bring the fulcrum for any movement of the abdomen to the joint between any two somites, the combined action of the muscles of the somites anterior to this point keeping the anterior part of the abdomen rigid. The abdomen may be bent in practically any direction by means of the longitudinal bands of muscles, which may be contracted individually or in combinations, throughout the length of the abdomen, or in any part of it.

Near the middle of each abdominal somite there is, on either side, a pair of muscles which run from the dorsal to the ventral surface, fig. 8, stm. These provide for a dorso-ventral contraction of the abdomen, which is of service in respiration.

In the sixth and seventh abdominal somites there is, in addition to the typical muscles already mentioned, a set of muscles

which have to do with the movements of the ovipositor. These muscles are eight in number, four on either side of the median line. They are attached at their ventral ends to the ovipositor, and run dorsally and somewhat laterally around the intestine to be attached to the dorsal wall of the abdomen. When these muscles are contracted they bring the ovipositor out from its position in the groove on the seventh and eighth abdominal somites, where it lies when not in use, to the position in which it is used in depositing eggs. In this position it is placed at an angle of about thity degrees with the abdomen.

In the thorax the segmental arrangement of the muscles is greatly modified. On the dorsal side there are two rows of longitudinal muscles like those of the abdomen. On the median dorsal line of the mesothorax four muscles are attached. One pair of these muscles runs anteriorly and laterally and is attached to the ventral wall of the prothorax just posterior to the anterior legs. The other pair passes posteriorly and laterally and is attached just posterior to the hind legs. The arrangement of these muscles is such that when they are viewed from the dorsal side they form a cross the four extremities of which are attached to the ventral surface.

Attached to the fold of the integument that lies between the abdomen and metathorax, with their posterior ends overlapping the ventral ends of the posterior pair just mentioned, is another pair of muscles. These converge as they run forward, and are attached to a prominence on the floor of the metathorax near its anterior end. Between the posterior ends of these two sets of muscles another pair of muscles is attached. These diverge as they run forward, and are attached at the bases of the third pair of legs. From this point they converge and at the anterior end of the somite they are attached to the fold of integument between the meta- and mesothorax. Another pair of muscles is attached to the floor of the metathorax; they diverge as they run forward and are attached at the bases of the legs in the mesothorax. From this point they converge and are attached together on the floor of the posterior part of the prothorax.

In the prothorax there is a pair of muscles that has the same arrangement as the muscles last described, being attached at their posterior ends to the fold of integument between the pro- and mesothorax and running forward to the head. These also are attached near the bases of the legs in their somite. Another

pair, attached by a single head in the posterior part of this somite, diverge as they run forward, and are attached to the integumental fold between the head and prothorax. In the anterior part of this somite there are, on each side, three muscles which are attached at their ventral ends to the thorax, and at their dorsal ends to the head. In the posterior part of the head there are six muscles that are attached at their dorsal ends to the thorax and at their ventral ends to the head. These two sets of muscles cross one another at their middle points. The muscles that have to do with the movements of the mouth parts are situated in the anterior part of the head, on its ventral wall. A part of these muscles run anteriorly and dorsally to be attached to the front part of the head. The remainder run dorsally to be attached to the dorsal wall of the head.

Each leg is supplied with four muscles. One of these muscles lies along the floor of the thorax, and is attached at one end to a median ridge of the integument, and at the other end to the fold between the coxa and trochanter. This muscle serves as the flexor of the coxa. The other thoracic muscles of each leg are really the three heads of one muscle, the extensor of the coxa. These muscles are attached to the integument on the dorsal walls of the thoracic somites and at the other end to the integumental fold between the coxa and trochanter. The muscles in the next two joints of the leg (trochanter and femur) are arranged in much the same way, one of them acting as a flexor and the others as extensor. They are attached intersegmentally. In the next joint (tibia) there are only two muscles, one flexor and one extensor. Both of these muscles are continued into the tarsus by tendons. The tarsus has no muscles of its own.

In the winged forms there are, in the thorax, the muscles for the movement of the wings. These consist of two series on each side, one of which elevates and the other depresses the wings. Each series is made up of several muscles. There are two elevators and four depressors. Of these there is in each series, a single muscle that is much larger than the others and that does the greater part of the work in flight. The others serve to keep the wings in their proper position. All of these muscles are attached at one end to the ventral wall of the thorax, and at the other to the wings. The elevators are attached inside, and the depressors outside of the point which serves as the fulcrum for the movements of the wings.

## NERVOUS SYSTEM.

*Figs. 7 and 9.*

The central nervous system is concentrated. It consists of five ganglia (morphologically pairs of ganglia), and a single large median nerve cord which passes from the posterior end of the fifth ganglion to the posterior part of the abdomen.

The cerebral ganglion, fig. 7, cg, is large and flat. It is divided superficially into halves by a cleft which is deep in front but shallow on the dorsal and ventral surfaces. Each half of the ganglion is pointed at its anterior end. The optic tracts pass out from the ganglion just posterior to these prominences. There is a slight constriction where they join the ganglion. Just posterior to the optic tract, there is on either side, a prominent swelling, the antennal lobe, from the ventral sides of which the antennal nerves pass anteriorly to the base of the antennae. The posterior part of the ganglion is narrower and thinner than the anterior part and is continued posteriorly over the anterior end of the first ventral ganglion and the œsophagus.

The surface of the first ventral ganglion clearly indicates that it is formed by the fusion of two ganglia, the infraœsophageal and the first thoracic. A well marked constriction separates the two. The nerves which supply the mouth parts are all given off from the anterior part of the ganglion. The nerves to the first pair of legs, as well as those of the muscles and other organs of the prothorax are given off from the posterior part of the ganglion. The nerves which go to the legs are very large, and pass from the side of the ganglion, obliquely to the bases of the legs.

The second thoracic ganglion is connected with the first by a broad commissure. It is much smaller than the first, nearly circular in outline and lies in the anterior part of the mesothorax. The nerves which go to the middle legs are given off from its posterior part. These nerves come from the under side of the ganglion and run obliquely backward to the bases of the legs.

The third thoracic ganglion is small, nearly round in outline, and is connected with the second by a very short broad commissure. It lies in the extreme posterior part of the mesothorax, and sends a large nerve obliquely backward to each of the legs that are attached to the metathorax.

The fourth ganglion is the largest of any in the ventral chain, and compared with them it is long and narrow. It lies partly in the metathorax and partly in the abdomen, and is connected with the third thoracic ganglion by a long slender commissure. It gives off nerves to the organs of the somites which it occupies, and is connected with the somites lying posterior to it, by the long nerve cord passing from its posterior end.

The cord which passes from the fourth ventral ganglion, runs posteriorly to the sixth abdominal somite, where it breaks up into a number of nerve fibers. These supply the reproductive organs, the special muscles of the reproductive organs, and the other organs and muscles in the last two somites of the abdomen.

All of the ganglia correspond very closely in their minute structure. Each ganglion is enclosed in two delicate membranes. Beneath these membranes there is a layer, of varying thickness, made up of large nerve cells, which stain deeply. This layer of nerve cells is thickest at a point a little way from either end. Between these thickened portions the layer of nerve cells is much thinner, and it is entirely wanting where the ganglion narrows down to form the commissure. The nerve cells are pear shaped and a single nerve fiber passes from the smaller end of each cell.

The central part of the ganglion is made up of fibers that run, for the most part longitudinally, except where some large nerve is given off. The commissures are composed entirely of nerve fibers, together with the two envelopes that surround them. The cord which passes from the fourth ventral ganglion is composed entirely of nerve fibers.

### EYES.

The compound eyes, fig. 14, ei. are comparatively small, (about .06 mm. in diameter), placed on the sides of the head just back of the antennæ, and nearly circular in outline. Each eye is made up of from one hundred to one hundred and twenty facets. The facets in the two eyes of an individual may differ in number from ten to fifteen. Each facet is irregular in outline, but approximately circular and is strongly convex on the surface, so that the exterior of the eye has a roughened appearance. The facets near the center of the eye are larger than those near the outside. Those at the center are seven microns in

diameter, while those at the outside range from five to six microns in diameter.

The eyes are deeply colored with a dark brown pigment, which makes them very conspicuous. The ocelli, three in number, are placed between the compound eyes on the dorsal surface of the head, and are arranged in the form of a triangle. The anterior median ocellus is about seven microns in diameter and each posterior ocellus is about ten microns in diameter. They are not very conspicuous, as they have little pigment and are not raised much above the surrounding parts.

## REPRODUCTIVE SYSTEM.

*Fig. 7.*

The reproductive apparatus of the female insect consists of two ovaries, each of which is made up of five ovarian tubes. Each ovarian tube is divided into three sections. First; the terminal thread, at the anterior end, by which that end of the ovary is attached to the dorsal wall of the abdomen. These threads all run together to form a single thread on each side. Second; the terminal chamber, which contains undifferentiated cell elements which give rise to the eggs. Third; the actual ovarian tubes, the chambered part of which contains the eggs.

The ovarian tubes are long and slender and extend from the fifth to the first abdominal somite. They contain no chambers of nutritive matter. At the posterior end of the ovaries there is, on each side, a very short oviduct, which soon unites with its fellow to form the common oviduct, fig. 7, ovd. This extends from the fifth to the junction between the sixth and seventh abdominal somites, where it opens to the exterior at the base of the ovipositor. There is no well marked receptaculum seminalis or accessory sac. The walls of the ovaries are thin, and are made up mostly of connective tissue. The walls of the oviduct are much thicker and well supplied with muscle fibers.

The largest eggs in the lower chambers are about .15 mm. in length and .06 mm. in thickness. They are deeply concave on the surface that is turned toward the median line of the body, and are covered with a strong membrane.

### CIRCULATORY SYSTEM.

The circulatory system consists of a contractile dorsal vessel, the heart, which begins in the sixth abdominal somite and passes forward into the thorax. Here it gives rise to the aorta, which runs forward, ventral to the salivary glands to the head. The heart is very small and lies just below the dorsal wall above the intestine. In almost all of the specimens examined it was so badly collapsed that it was scarcely visible. Its walls are exceedingly thin and have very few muscle fibers. The alary muscles are very poorly developed. Four pairs of ostia were found; these were in the third, fourth, fifth and sixth abdominal somites.

### RESPIRATORY SYSTEM.

*Figs. 14 and 15.*

There are three pairs of stigmata, one at the anterior end of the mesothorax, and one each on the first and seventh abdominal somites. The stigmata are quite large, and have a sieve-like covering to prevent the ingress of solid particles. From the stigmata on the mesothorax tracheæ are supplied to the head and its appendages, to the prothorax and fore limbs, and to the organs and appendages of the meso- and metathorax. The two stigmata on each side of the abdomen are connected by a large tracheal trunk, which runs along the abdomen near its lateral wall. From these trunks three branches are given off in each of the six anterior abdominal somites. One of these branches supplies the dorsal part of the somite, another the ventral part of the somite, and a third passes nearly straight into the body, going chiefly to the viscera. The two posterior somites of the abdomen are supplied by long tracheal branches which come from the stigmata on the seventh abdominal somite. The tracheæ are very small and thin walled, and the walls have a chitinous lining that shows spiral markings. They are supplied to the viscera very abundantly, and serve the double purpose of respiration and to keep the viscera in place.

### FAT BODY.

The fat body is large in all stages of development. In the larva it fills all of the space between the viscera. It is made up of a frame-work of large cells, each of which contains a large drop-

let of fatty matter. In the older stages the most of the fatty matter has been absorbed, but the cells still persist.

### HABITS.

The insects usually live in some part of the grass plant where they are protected from any disturbance. When a sheath is torn down so as to disturb them, they begin to run about seeking some place in which to hide themselves. If they are unsuccessful in their search, they remain practically still and bend up the abdomen as if ready to sting the intruder.

In the act of egg laying the female arches the body so as to bring her weight to bear upon the ovipositor, which is slowly worked down through the surface of the leaf into the under lying tissue. The egg is then passed down the groove on the surface of the ovipositor and lodged just beneath the epidermis of the leaf. This process takes about one and a half minutes for its completion. After an egg has been deposited, the insect moves off and begins to feed. It frequently happens that the serrated edges of the ovipositor become so firmly fastened in the tissues of the plant that the insect is unable to free itself and finally dies.

The insects attack a number of the common grasses during the season, but in the early months its ravages are mostly confined to the June grass, *Poa pratensis,* on which the results of its work are the most manifest. As the season advances it is found quite abundantly in timothy, *Phleum pratense,* and on several species of Panicum, Agrostis, and Festuca.

For treatment see page 128.

## REFERENCE LETTERS.

ab abdomen.
abg abdominal ganglion.
ant antennæ.
antn antennal nerve.
cg cerebral ganglion.
cox coxa.
ei eye.
fbc cells of the fat body.
fem femur.
fl fore leg.
fw fore wing.
hd head.
hi hind-intestine.
hl hind leg.
ht heart.
hw hind wing.
hyp hypodermis.
ism intersegmental muscles.
lbm labium.
lhr labrum.
lm muscles of the legs.
ln nerves of the legs.
lp labial palp.
mi mid-intestine.
ml middle leg.
mp mouth parts.
mpm muscles of the mouth parts.
msth mesothorax.
mt malpighian tubules.
mtth metathorax.
mx maxilla.
mxp maxillary palp.
nc nerve cord.
oes œsophagus.
ov ovary.
ovd oviduct.
ovp ovipositor.
ovpm muscles of the ovipositor.
ovt ovarian tubes.
prth prothorax.
ps piercing setæ.
rg rectal glands.
sd salivary duct.
sg salivary gland.
st stigma.
stm sterno-tergal muscles.
tars tarsus.
thor 1 first thoracic ganglion.
thor 2 second thoracic ganglion.
thor 3 third thoracic ganglion.
tib tibia.
tr tracheæ.
troch trochanter.
trt tracheal trunk.
wc wing case.
wp rundimentary wing.

## PLATE I.

Fig. 1. Larva.

Fig. 2. Pupa.

Fig. 3. Adult male.

Fig. 4. Anterior surface of head reconstructed to show the mouth parts in position.

See page 113 for reference letters.

PLATE I.

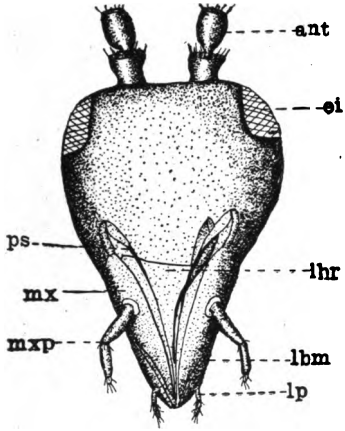



Fig. 4.

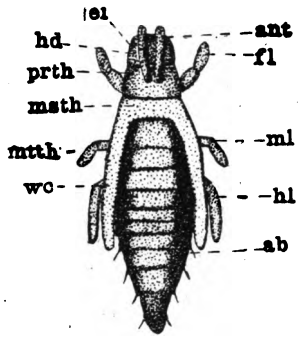



Fig. 2.

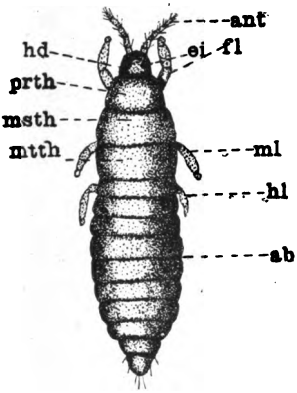



Fig. 1.

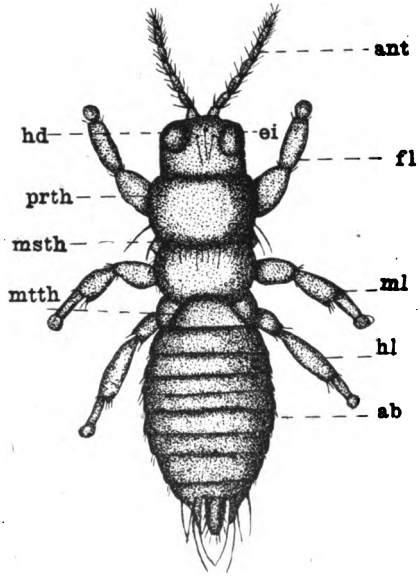



Fig. 3.

## PLATE II.

Fig. 5. Adult wingless female.

Fig. 6. Adult winged female.

See page 113 for reference letters.

PLATE II.

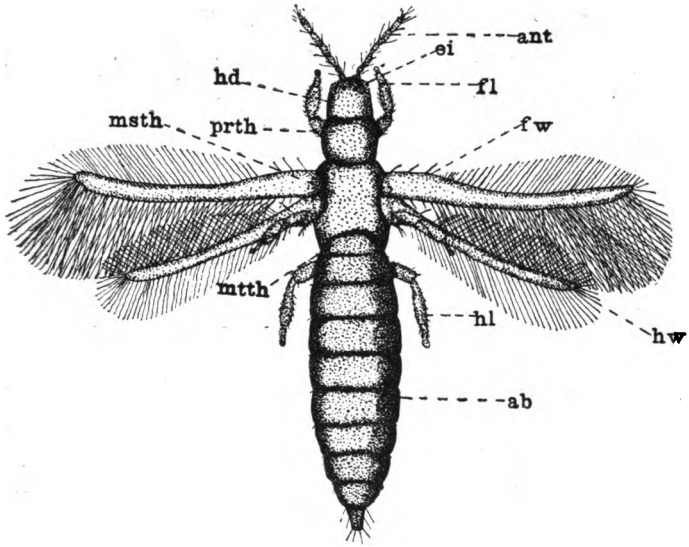



Fig. 6.

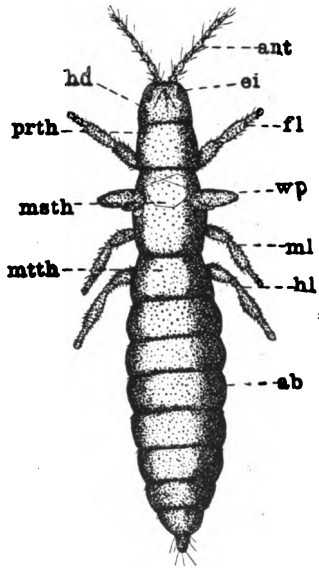



Fig. 5.

## PLATE III.

Fig. 7. Adult wingless female with the dorsal part of the body removed.

See page 113 for reference letters.

PLATE III.

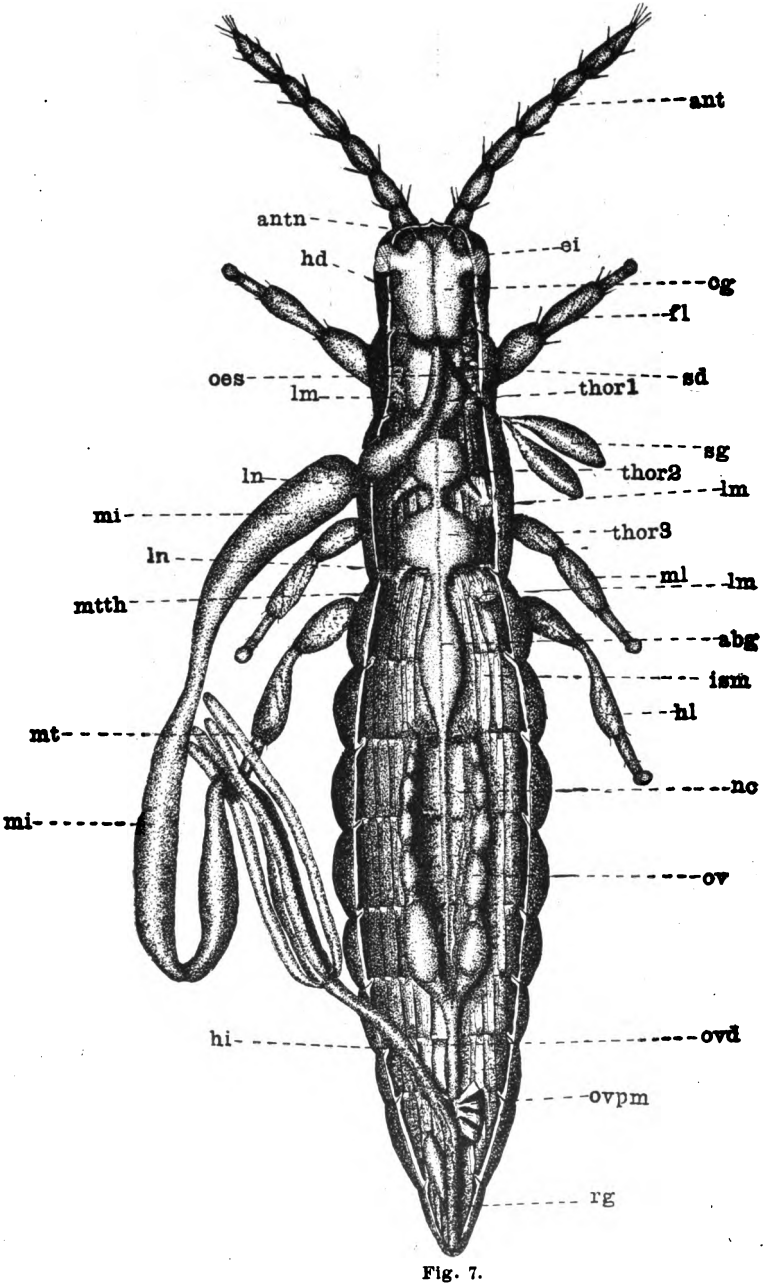



Fig. 7.

## PLATE IV.

**Fig. 8.** Ventral wall of an adult insect showing the arrangement of ventral muscles.

See page 113 for reference letters.

PLATE IV.

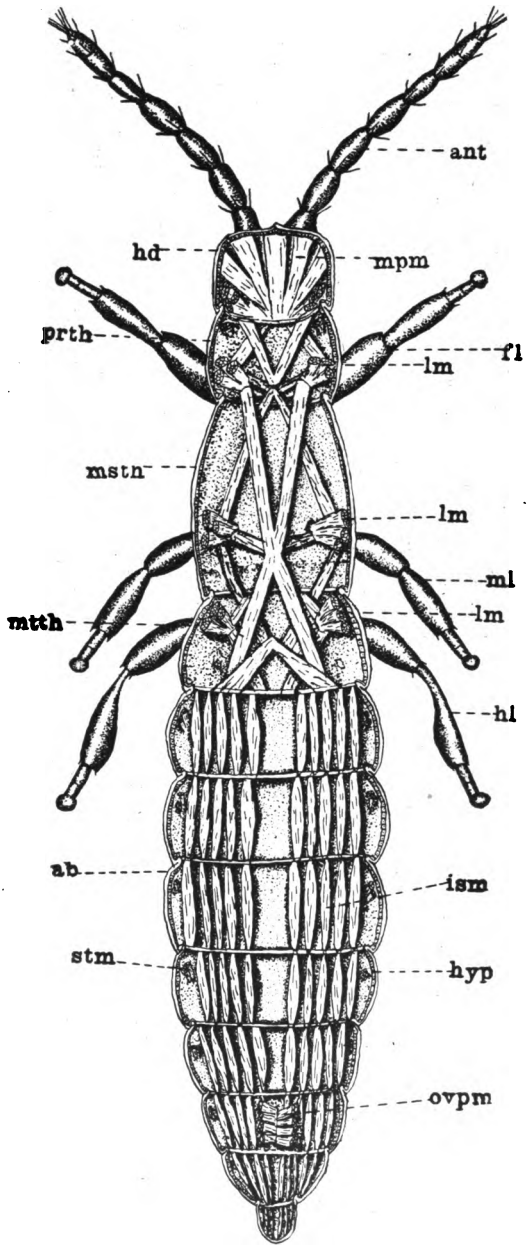



Fig. 8.

## PLATE V.

Fig. 9. Sagittal section through the median plane of the body showing the arrangement of the ganglia.

Fig. 10. Sagittal section through a pupa a little to one side of the median line showing the attachment of the intersegmental muscles.

See page 113 for reference letters.

PLATE. V.

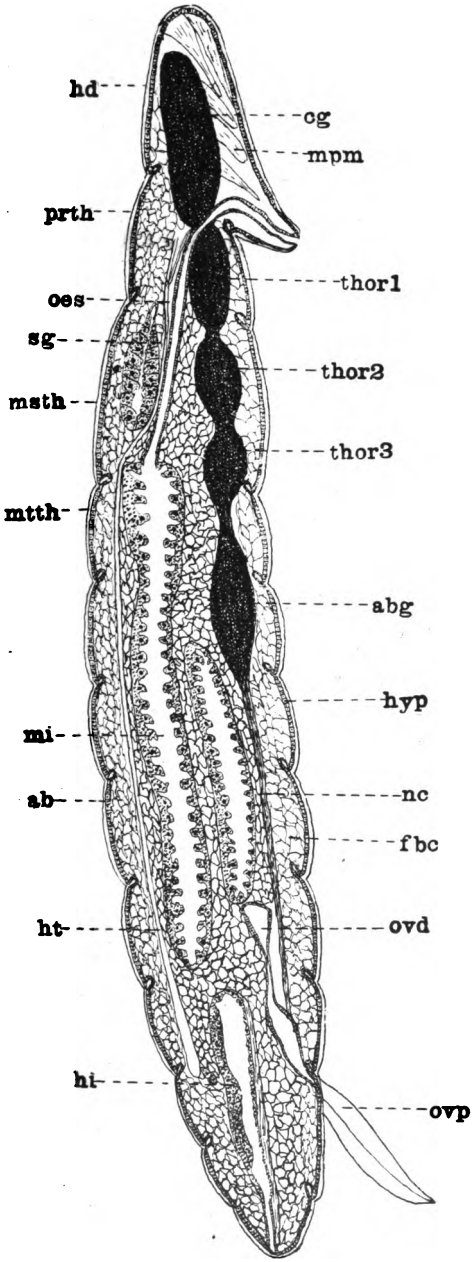



Fig. 9.

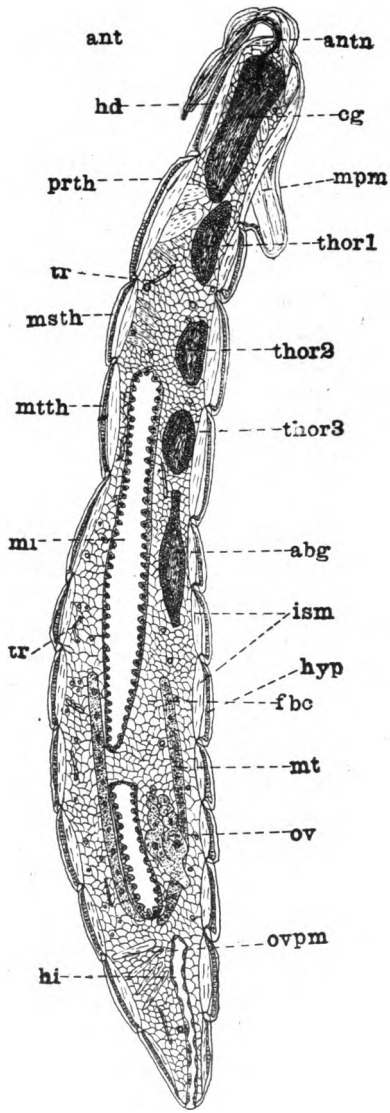



Fig. 10.

## PLATE VI.

Fig. 11. Transverse section through the posterior part of the head of a wingless adult female.

Fig. 12. Transverse section through the posterior part of the first thoracic ganglion.

Fig. 13. Transverse section through the fourth abdominal somite of a winged adult female.

See page 113 for reference letters.

PLATE VI.

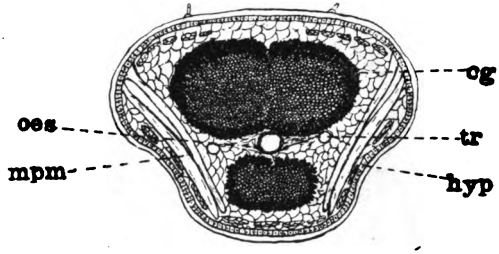



Fig. 11.

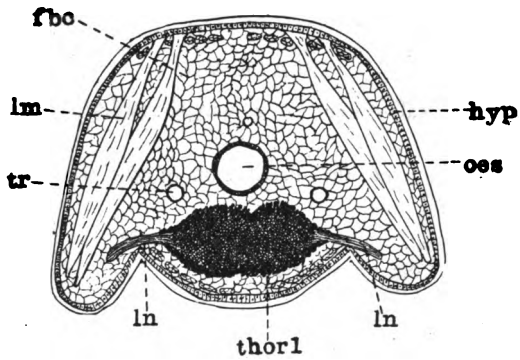



Fig. 12.

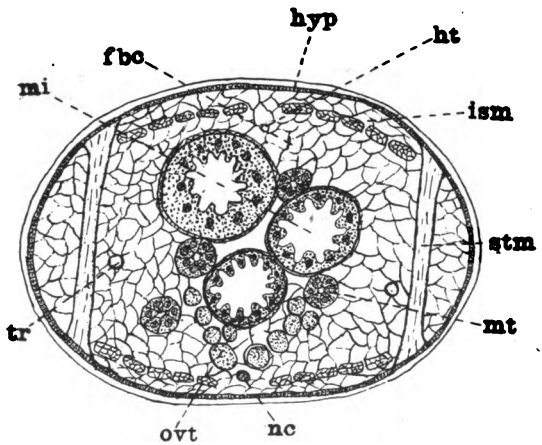



Fig. 13.

## PLATE VII.

Fig. 14. Tracheal system of a wingless adult female (somewhat diagrammatic).

Fig. 15. Diagram of the distribution of the tracheæ in a typical abdominal somite.

Fig. 16. Fore leg of an adult wingless female.

See page 113 for reference letters.

PLATE VII.

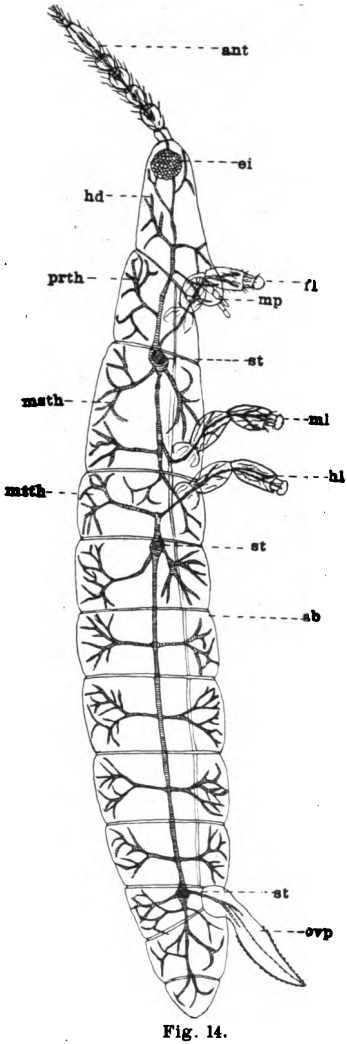



Fig. 14.

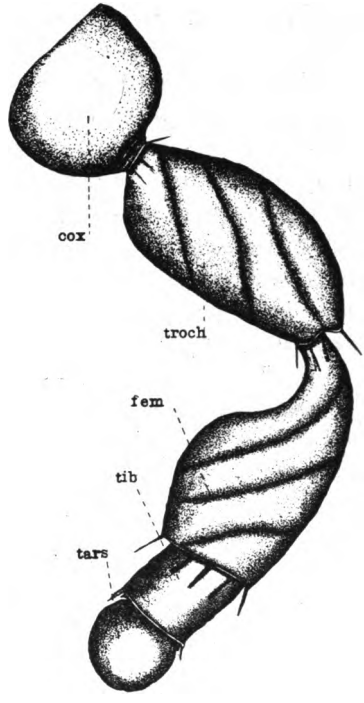



Fig. 16.

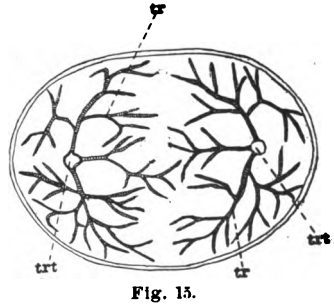



Fig. 15.

TREATMENT.

As the thrips feeds by sucking the juices of the plants, contact poisons, as kerosene emulsion, or whale oil soap, are the only ones which are of use in combating it.

Where only a small area is infested, one of the insecticides just mentioned or even a liberal application of water will prove successful in controlling the pest. When a large area is infested, the application of an insecticide is not feasible on account of the expense of materials and application. In such a case the burning of the dead stalks after the ground has frozen in the fall, so as to secure a close burn, without injuring the roots of the grass, may prove successful. With badly run out fields, which are the ones most likely to be badly infested, the best remedy is deep plowing in the fall or in the early spring before the grass has started. If this is followed by thorough cultivation, none of the insects will be able to make their way to the surface of the ground.

# CEREAL BREAKFAST FOODS.

L. H. MERRILL and E. R. MANSFIELD.

Three years ago a bulletin was issued from this Station containing the analyses of about 40 cereal breakfast foods. The demand for the bulletin proved unexpectedly large and persistent and the edition was soon exhausted. In view of the growing importance of this class of foods it has seemed advisable to issue another bulletin upon the same subject, containing the analyses of those preparations which are found upon the market to-day.

## THE CEREAL GRAINS.

Among the vegetable foods best adapted to the wants of man, the cereal grains occupy by far the most prominent place. The methods by which these grains are prepared for our use are so various and the manufactured products so multitudinous that it is difficult to fix the relative food value of the grains themselves. Thus it would be manifestly unwise to generalize upon the relative value of wheat and corn, if we base our conclusions merely upon the chemical composition of a patent flour on the one side, from the wholly decorticated and degerminated kernel, and that of a corn meal on the other side, in which most of the outer coating of the kernel and practically all the germ are left in the finished product. Nevertheless a comparison of the grains from the chemical standpoint is not without interest and is attempted in the following table, which includes all the cereals concerned in this bulletin. Since barley, oats and rice are always decorticated before they are eaten, the analyses of these grains entire are not given.

PERCENTAGE COMPOSITION OF BARLEY, CORN, OATS, RICE AND WHEAT.

| | Moisture. | Proteids. | Ether extract. | Crude fiber. | Carbohydrates other than crude fiber. | Ash. |
|---|---|---|---|---|---|---|
| | Per ct. | Per ct. | Pr ct. | Pr ct. | Per ct. | Pr ct. |
| Barley meal * | 14.83 | 10.89 | 1.23 | 0.47 | 71.85 | .63 |
| Barley, pearl * | 12.82 | 7.25 | 1.15 | 1.36 | 76.19 | 1.23 |
| Corn † | 10.75 | 10.00 | 4.25 | 1.75 | 71.75 | 1.50 |
| Oats, rolled, 20 analyses ‡ | 7.70 | 16.70 | 7.30 | 1.30 | 64.90 | 2.10 |
| Rice, hulled, unpolished § | 12.00 | 8.00 | 2.00 | 1.00 | 76.00 | 1.00 |
| Rice, hulled, polished § | 12.40 | 7.50 | .40 | .40 | 78.80 | .50 |
| Wheat † | 10.60 | 12.25 | 1.75 | 2.40 | 71.25 | 1.75 |

* Knight. Food and Its Functions, p. 161.

† Wiley. Foods and Food Adulterants, Bul. 13, part 7, Div. Chem., U. S. Dept Agr., p. 1190.

‡ U. S. Dept. Agr., Office of Expt. Stations, Bul. 28 (Revised), p. 57.

§ Wiley. Foods and Food Adulterants, Bul. 13, part 9, Div. Chem., pp. 1182-3.

*Barley* is not very extensively eaten in this country, where its principal use has been in broths and soups. In the so-called barley bread, a considerable proportion of wheat flour is mixed with the barley meal. According to Knight, such bread is usually heavy, rather indigestible, and somewhat laxative. The latter property is shared by many of the coarser cereal preparations and can probably be attributed to the mechanical condition, rather than to the chemical composition of the food. As barley is very generally employed in the manufacture of malt, its presence in the malted foods is to be expected.

*Corn* from its composition and cheapness deserves a more extended use. Although below wheat and hulled oats in the amount of protein which it contains, it is very rich in fat, ranking next to hulled oats in this respect. As corn meal, the form in which it is generally put upon our markets, it is regarded as less digestible than the other cereal products. This is probably in large part due to its coarse milling and the large amount of bran which it contains. The fat, which is largely confined to the germ, is a source of weakness, since it readily becomes rancid and the meal becomes musty. Hominy and samp, from which the germ has been removed, are free from this objection. An

improved method of milling corn is now coming into use by which the kernel is degerminated before being ground, the result being a product of much better keeping qualities.

*Oats.* The analysis of rolled oats given in the above table may be accepted as representing the composition of the kernel when deprived of its outer woody coating. In this condition their nutritive properties are in excess of those of any other of our common cereals. They contain one-third more protein than wheat and nearly four times as much fat. On the other hand they contain less starch than wheat; but since starch possesses a much lower nutritive value than protein and fat, the oats must be considered the more nutritious.

*Rice* is the poorest in proteids and ash of the cereals here considered and is correspondingly rich in starch. In China and the East Indies it forms the principal food of the poorer classes and failure of the rice crop would mean famine to at least one-third of the human race. In this country it is more generally cultivated than formerly, but its consumption is still largely in excess of the domestic production.

*Wheat* is by far the most important of our cereals, since it is the only one the proteids of which form a true gluten, the peculiar tenacity of which makes a leavened or "raised" bread possible. This property in itself must forever distinguish wheat as the bread-making cereal *par excellence.* Quite aside from this, however, the nutritive value of wheat must place it in the front rank of vegetable foods. In protein content it is excelled only by hulled oats.

## COMPOSITION OF CEREAL BREAKFAST FOODS.

During the past few years a large number of cereal breakfast foods has been placed upon the market and the number is constantly increasing.

The composition of many of these goods is given in the tables which follow. In the first two tables, pages 132-3, are summarized the analyses of the brands collected three years ago and reported in Bulletin 55 of this Station. All the other analyses here given are of new samples collected during the past few months, for the most part in Bangor and Portland. The list does not profess to include all the goods then obtainable, though the omissions are probably few.

## CEREAL FOODS ANALYZED IN 1902.

| Laboratory number. | Name. | Manufacturer. |
|---|---|---|
| | **CORN PREPARATIONS.** | |
| 6230 | Crown Flakes | Crown Cereal Company |
| 6231 | Hecker's Hominy | Hecker-Jones-Jewell Milling Co |
| 6232 | H-O Company's New Process Hominy | The H-O Company |
| 6233 | Mazama | Mazama Health Food Company |
| | **UNCOOKED OAT MEALS.** | |
| 6234 | A Oat Meal | American Cereal Company |
| 6235 | C Oat Meal | American Cereal Company |
| 6245 | McCann's Finest Oat Meal | John McCann |
| | **COOKED OAT PREPARATIONS.** | |
| 6242 | Hecker's Oat Meal | |
| 6244 | Hornby's H-O Oat Meal | The H-O Company |
| 6236 | American Cereal Company's Rolled Oats | American Cereal Company |
| 6237 | American Cereal Company's Rolled Oats | American Cereal Company |
| 6238 | Buckeye Rolled Oats | American Cereal Company |
| 6239 | Buckeye Rolled Oats | American Cereal Company |
| 6241 | Echo White Rolled Oats | Steward & Merriam |
| 6243 | Hecker's Rolled White Oats | Hecker-Jones-Jewell Milling Co |
| 6240 | Peoria Rolled Oats | Steward & Merriam |
| 6246 | Quaker Rolled White Oats | American Cereal Company |
| 6247 | Tip Top Rolled Oats | Akron Cereal Company |
| | **WHEAT PREPARATIONS.** | |
| 6264 | Fruen's Best Wheat Wafers | Fruen Cereal Company |
| 6263 | Fruen's Rolled Wheat | Fruen Cereal Company |
| 6254 | H-O Company's Breakfast Food | The H-O Company |
| 6256 | Old Grist Mill Rolled Wheat | Potter & Wrightington |
| 6258 | Pettijohn's Breakfast Food | American Cereal Company |
| 6249 | Cream of Wheat | Cream of Wheat Company |
| 6251 | Farinose | American Cereal Company |
| 6252 | Gould's Wheat Germ Meal | The Fould's Milling Company |
| 6268 | Germea | Sperry Flour Company |
| 6250 | Hecker's Farina | |
| 6257 | Old Plymouth Breakfast Food | Old Plymouth Cereal Company |
| 6259 | Pillsbury's Vitos | Pillsbury-Washburn Flour Mills |
| 6260 | Ralston Health Club Breakfast Food | Robinson-Danforth Company |
| 6261 | Wheatena | Health Food Company |
| 6262 | Wheatlet | The Franklin Mills |
| 6265 | Shredded Whole Wheat Biscuit | The Cereal Machine Company |
| | **GLUTEN PREPARATIONS.** | |
| 6248 | Cooked Gluten | Health Food Company |
| 6253 | Dr. Johnson's Glutine | Johnson's Educator Food Store |
| 6269 | Whole Wheat Gluten | Health Food Company |
| | **MISCELLANEOUS PREPARATIONS.** | |
| 6266 | Cook's Flaked Rice | American Rice Food & Mf'g Co |
| 6229 | Glen Mills Standard Crushed Barley | Johnson's Educator Food Store |
| 6267 | Grape-Nuts | Postum Cereal Company |
| 6286 | Malt Breakfast Food | The Malted Cereal Company |

## WEIGHTS OF NUTRIENTS, AND FUEL VALUE OF ONE POUND OF CEREAL FOODS AS FOUND IN THE MARKET.

| Laboratory number. | Price paid per package. | Weight contents of package. | Weight contents of package. | Price paid per pound. | Water. | Protein. | Fat. | Carbohydrates. | Ash. | Heat of combustion per pound. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cents. | Grams. | Lbs. | Cts. | Lb. | Lb. | Lb. | Lb. | Lb. | Calo. |
| 6230 | 5 | 400 | .88 | 5.7 | .120 | .061 | .009 | .787 | .004 | 1740 |
| 6231 | 12 | 1329 | 2.93 | 4.1 | .110 | .086 | .006 | .794 | .004 | 1730 |
| 6232 | 13 (2 for 25c.) | 1324 | 2.92 | 4.5 | .120 | .080 | .005 | .792 | .003 | 1725 |
| 6233 | 15 | 1136 | 2.28 | 6. | .107 | .086 | .010 | .792 | .005 | 1770 |
| 6234 | In bulk | | | 4. | .067 | .175 | .077 | .655 | .026 | 2625 |
| 6235 | In bulk | | | 4. | .079 | .143 | .074 | .686 | .019 | 1975 |
| 6245 | 55 | 2331 | 5.14 | 10.7 | .051 | .125 | .101 | .705 | .019 | 2055 |
| 6242 | 13 (2 for 25c.) | 828 | 1.83 | 7.1 | .091 | .189 | .074 | .627 | .019 | 1980 |
| 6244 | 15 | 933 | 2.06 | 7.3 | .093 | .134 | .080 | .674 | .019 | 1945 |
| 6236 | In bulk | | | 4. | .077 | .139 | .076 | .687 | .021 | 1975 |
| 6237 | In bulk | | | 4. | .069 | .153 | .076 | .683 | .020 | 1970 |
| 6238 | 8 lbs. for 25c. in bulk | | | 3.1 | .074 | .149 | .075 | .682 | .021 | 1955 |
| 6239 | 10 | 849 | 1.87 | 5.3 | .080 | .147 | .075 | .678 | .020 | 1970 |
| 6241 | 10 | 895 | 1.97 | 5.1 | .082 | .146 | .075 | .677 | .020 | 1965 |
| 6243 | 10 | 874 | 1.93 | 5.2 | .086 | .144 | .081 | .669 | .019 | 1980 |
| 6240 | 4 cts. per lb., 7 lbs. for 25 cts., in bulk | | | 4. | .068 | .145 | .078 | .689 | .020 | 1970 |
| 6246 | 13 (2 for 25c.) | 851 | 1.88 | 6.9 | .081 | .148 | .086 | .666 | .020 | 1955 |
| 6247 | 5 | 554 | 1.22 | 4.1 | .091 | .161 | .079 | .648 | .020 | 1950 |
| 6264 | 13 (2 for 25c.) | 857 | 1.89 | 6.9 | .113 | .093 | .021 | .754 | .019 | 1750 |
| 6263 | In bulk | | | 4. | .106 | .095 | .020 | .761 | .017 | 1745 |
| 6254 | 10 | 578 | 1.27 | 7.9 | .117 | .101 | .016 | .748 | .018 | 1765 |
| 6256 | 15 | 952 | 2.10 | 7.1 | .112 | .096 | .019 | .756 | .016 | 1775 |
| 6258 | 13 (2 for 25c.) | 841 | 1.85 | 7.0 | .107 | .119 | .018 | .739 | .017 | 1780 |
| 6249 | 17 | 853 | 1.88 | 9.0 | .106 | .118 | .010 | .763 | .004 | 1775 |
| 6251 | 15 | 936 | 2.06 | 7.3 | .094 | .141 | .030 | .720 | .014 | 1840 |
| 6252 | 13 (2 for 25c.) | 830 | 1.83 | 4.9 | .111 | .109 | .023 | .743 | .014 | 1745 |
| 6268 | 15 | 795 | 1.75 | 8.6 | .115 | .129 | .024 | .719 | .013 | 1795 |
| 6250 | 13 (2 for 25c.) | 423 | .93 | 14.0 | .114 | .105 | .009 | .767 | .004 | 1760 |
| 6257 | 15 | 853 | 1.88 | 8.0 | .123 | .129 | .022 | .716 | .011 | 1775 |
| 6259 | 13 (2 for 25c.) | 951 | 2.10 | 6.2 | .093 | .119 | .015 | .766 | .007 | 1815 |
| 6260 | 15 | 857 | 1.89 | 8.0 | .121 | .107 | .014 | .751 | .008 | 1745 |
| 6261 | 25 | 992 | 2.19 | 11.4 | .086 | .150 | .035 | .712 | .017 | 1885 |
| 6262 | 13 (2 for 25c.) | 859 | 1.89 | 6.9 | .116 | .136 | .019 | .718 | .011 | 1780 |
| 6265 | 13 (2 for 25c.) | 398 | .88 | 14.8 | .108 | .106 | .015 | .756 | .015 | 1780 |
| 6248 | 25 | 416 | .92 | 27.3 | .089 | .154 | .035 | .699 | .022 | 1880 |
| 6253 | 25 | 410 | .90 | 27.7 | .102 | .138 | .009 | .741 | .011 | 1815 |
| 6269 | 55 (5 lbs. bag) | 2274 | 5.01 | 11. | .112 | .159 | .046 | .656 | .027 | 1865 |
| 6266 | 15 | 387 | .85 | 17.6 | .114 | .079 | .001 | .802 | .004 | 1725 |
| 6229 | 15 | 908 | 2.00 | 7.5 | .103 | .100 | .009 | .779 | .010 | 1760 |
| 6267 | 15 | 428 | .94 | 15.9 | .053 | .117 | .011 | .797 | .023 | 1870 |
| 6286 | 15 | 675 | 1.49 | 10.1 | .080 | .134 | .022 | .750 | .014 | 1863 |

## CEREAL FOODS.

| Laboratory number. | Name. | Manufacturer. |
|---|---|---|
| | **CORN PREPARATIONS.** | |
| 6580 | F S Granulated Hominy | American Cereal Company |
| 6571 | Hecker's Hominy | Hecker-Jones-Jewell Milling Co |
| 6560 | H-O Company's New Process Hominy | H-O Company |
| 6582 | Nichol's Pearl Hominy | Austin, Nichols & Company |
| 6572 | Pierce's Hominy | S. S. Pierce |
| 6561 | Ralston Hominy Grits | Purina Mills |
| 6581 | Nichols' Snow White Samp | Austin, Nichols & Company |
| 6579 | Cerealine Flakes | Cerealine Manufacturing Company |
| | **OAT PREPARATIONS.** | |
| 6563 | Banner Rolled Oats | American Cereal Company |
| 6564 | Buckeye Rolled Oats | American Cereal Company |
| 6553 | Hornby's Steam Cooked Oat Meal | H-O Company |
| 6566 | McCann's Finest Oat Meal | Beaumond Mills, Dogheda, Ireland |
| 6567 | Mother's Crushed Oats | Akron Cereal Company |
| 6555 | Oatnuts Food | Liberty Pure Food Company |
| 6589 | Old Grist Mill Rolled Oats | Potter & Wrightington |
| 6568 | Pillsbury's Flaked Oat Food | Pillsbury-Washburn Flour Mills Co. |
| 6576 | Quaker Oats | American Cereal Company |
| 6556 | Quaker Rolled White Oats | American Cereal Company. |
| 6557 | Ralston Health Oats | Purina Mills |
| 6578 | Rob Roy Cut Oats | American Cereal Company. |
| 6577 | Rob Roy Rolled Oats | American Cereal Company |
| 6716 | Saxon Rolled Oats | American Cereal Company |
| | **WHEAT PREPARATIONS.** | |
| 6543 | California Wheatine | Empire Milling Company |
| 6544 | Cream of Wheat | Cream of Wheat Company |
| 6545 | Fould's Wheat Germ Meal | Fould's Milling Company |
| 6570 | Fruen's Best Wheat Flakes | Fruen Cereal Company |
| 6583 | F S Parched Farinose | American Cereal Company |
| 6584 | Germea | Sperry Flour Company |
| 6593 | Granose Biscuit | Battle Creek Sanitarium Food Co. |
| 6591 | Granose Flakes | Battle Creek Sanitarium Food Co. |
| 6585 | Granula | Our Home Granula Company |
| 6546 | H-O Company's Breakfast Wheat | H-O Company |
| 6587 | Old Grist Mill Rolled Wheat | Potter & Wrightington |
| 6588 | Old Grist Mill Toasted Wheat | Potter & Wrightington |
| 6548 | Pettijohn's Breakfast Food | American Cereal Company |
| 6549 | Pillsbury's Vitos | Pillsbury-Washburn Flour Mills Co. |
| 6550 | Ralston Health Breakfast Food | Robinson-Danforth Milling Co |
| 6573 | Shredded Whole Wheat | National Food Company |
| 6606 | Sugarnuts | E. Merritt & Sons |
| 6551 | Wheatena | Health Food Company |
| 6552 | Wheatlet | Franklin Mills Company |
| | **MALTED FOODS.** | |
| 6590 | Brittle Bits | American Cereal Company |
| 6569 | Force | The Force Food Company |
| 6558 | Malt-Barley Breakfast Food | Malted Cereals Company |
| 6547 | Malt Breakfast Food | Malted Cereals Company. |
| 6554 | Malt-Oats Breakfast Food | Malted Cereals Company. |
| | **MISCELLANEOUS PREPARATIONS.** | |
| 6562 | Cook's Flaked Rice | Am. Rice Food Manufacturing Co. |
| 6574 | Cream of Cereals | Sam. W. Weidler |
| 6575 | Grape-Nuts | Postum Cereal Company |
| 6559 | Ralston Health Barley Food | Robinson-Danforth Milling Co. |

## CEREAL FOODS, WHERE PURCHASED AND COST.

| Laboratory number. | Where purchased. | Price paid per package. | Weight contents of package. | Weight contents of package. | Price paid per pound. |
|---|---|---|---|---|---|
| | | Cents. | Grams. | Lbs. | Cts. |
| 6580 | W. L. Wilson & Co., Portland | 15 | 737 | 1.63 | 9.2 |
| 6571 | A. A. Gilbert, Orono | 15 | 1366 | 3.01 | 5.0 |
| 6560 | Fred T. Hall & Co., Bangor | 15 | 1346 | 2.97 | 5.0 |
| 6582 | Geo. C. Shaw & Co., Portland | 22 | 2231 | 4.92 | 4.5 |
| 6572 | James H. Snow & Co., Bangor | In bulk | – | – | 5.0 |
| 6561 | Fred T. Hall & Co., Bangor | 10 | 826 | 1.82 | 5.5 |
| 6581 | Geo. C. Shaw & Co., Portland | 10 | 2115 | 4.66 | 2.1 |
| 6579 | Geo. C. Shaw & Co., Portland | 15 | 744 | 1.64 | 9.1 |
| 6563 | T. F. Cassidy & Son, Bangor | 25 | 1945 | 4.29 | 5.8 |
| 6564 | A. A. Gilbert, Orono | 10 | 894 | 1.97 | 5.1 |
| 6553 | Fred T. Hall & Co., Bangor | 15 | 876 | 1.93 | 7.8 |
| 6566 | J. C. Norton & Co., Bangor | 55 | 2295 | 5.06 | 10.9 |
| 6567 | J. C. Norton & Co., Bangor | 13(2 for 25) | 828 | 1.83 | 7.1 |
| 6555 | Fred T. Hall & Co., Bangor | 12 | 956 | 2.11 | 5.7 |
| 6589 | Geo. C. Shaw & Co., Portland | 10 | 825 | 1.82 | 5.5 |
| 6568 | Staples & Griffin, Bangor | 10 | 860 | 1.90 | 5.3 |
| 6576 | Staples & Griffin, Bangor | In bulk | – | – | 3.1 |
| 6556 | Fred T. Hall & Co., Bangor | 12 | 857 | 1.89 | 6.3 |
| 6557 | Fred T. Hall & Co., Bangor | 10 | 624 | 1.73 | 5.8 |
| 6578 | A. A. Gilbert, Orono | In bulk | – | – | 5.0 |
| 6577 | A. A. Gilbert, Orono | In bulk | – | – | 5.0 |
| 6716 | T. White, Bangor | 25 | 2002 | 4.41 | 5.7 |
| 6543 | Fred T. Hall & Co., Bangor | 15 | 857 | 1.89 | 7.9 |
| 6544 | Fred T. Hall & Co., Bangor | 15 | 771 | 1.70 | 8.8 |
| 6545 | Fred T. Hall & Co., Bangor | 13 | 802 | 1.77 | 7.3 |
| 6570 | J. C. Norton & Co., Bangor | 13 | 836 | 1.84 | 7.1 |
| 6583 | W. L. Wilson & Co., Portland | 12 | 904 | 2.00 | 6.0 |
| 6584 | W. L. Wilson & Co., Portland | 14 | 761 | 1.68 | 8.3 |
| 6593 | Geo. C. Shaw & Co., Portland | 12½ | 304 | .67 | 18.6 |
| 6591 | Geo. C. Shaw & Co., Portland | 15 | 304 | .67 | 22.4 |
| 6585 | W. L. Wilson & Co., Portland | 25 | 417 | .92 | 27.2 |
| 6546 | Fred T. Hall & Co., Bangor | 12 | 558 | 1.23 | 9.8 |
| 6587 | W. L. Wilson & Co., Portland | 13(2 for 25) | 865 | 1.91 | 6.1 |
| 6588 | W. L. Wilson & Co., Portland | 10 | 512 | 1.13 | 8.8 |
| 6548 | Fred T. Hall & Co., Bangor | 13 | 842 | 1.85 | 7.0 |
| 6549 | Fred T. Hall & Co., Bangor | 13 | 927 | 2.04 | 6.4 |
| 6550 | Fred T. Hall & Co., Bangor | 13 | 821 | 1.81 | 7.2 |
| 6573 | J. C. Norton & Co., Bangor | 13(2 for 25) | 396 | .87 | 15.0 |
| 6606 | E. Merritt & Sons, Houlton | In bulk | – | – | 5.0 |
| 6551 | Fred T. Hall & Co., Bangor | 25 | 1064 | 2.34 | 10.7 |
| 6552 | Fred T. Hall & Co., Bangor | 13 | 863 | 1.90 | 6.8 |
| 6590 | W. L. Wilson & Co., Portland | 13 | 472 | 1.05 | 12.5 |
| 6569 | James H. Snow & Co., Bangor | 15 | 413 | .91 | 16.5 |
| 6558 | Fred T. Hall & Co., Bangor | 13 | 594 | 1.31 | 10.0 |
| 6547 | Fred T. Hall & Co., Bangor | 13(2 for 25) | 624 | 1.38 | 9.4 |
| 6554 | Fred T. Hall & Co., Bangor | 13(2 for 25) | 617 | 1.36 | 9.6 |
| 6562 | Fred T. Hall & Co., Bangor | 13 | 324 | .71 | 18.2 |
| 6574 | T. F. Cassidy & Son, Bangor | 15 | 864 | 1.90 | 7.9 |
| 6575 | J. C. Norton & Co., Bangor | 15 | 466 | 1.03 | 14.6 |
| 6559 | Fred T. Hall & Co., Bangor | 13 | 858 | 1.89 | 6.9 |

## PERCENTAGE COMPOSITION OF CEREAL FOODS CALCULATED TO WATER-FREE BASIS.

| Laboratory number | Name. | Nitrogen. | Protein. (Nitrogen x 6.25.) | Fat. | Crude fiber. | N-free extract. | Ash. | Heat of combustion per gram. |
|---|---|---|---|---|---|---|---|---|
| | CORN PREPARATIONS. | Prct. | Per ct. | Prct. | Prct. | Per ct. | Prct. | Cal. |
| 6580 | F S Granulated Hominy ... ..... | 1.64 | 10.28 | .54 | .32 | 88.62 | .24 | 4.250 |
| 6571 | Hecker's Hominy.... ..... | 1.69 | 10.55 | .36 | .42 | 88.46 | .21 | 4.283 |
| 6560 | H-O Co's New Process Hominy... | 1.57 | 9.83 | 1.05 | .36 | 88.29 | .46 | 4.305 |
| 6582 | Nichol's Pearl Hominy ..... ..... | 1.50 | 9.36 | .41 | .29 | 89.77 | .17 | 4.240 |
| 6572 | Pierce's Hominy. ..... ..... | 1.45 | 9.05 | .66 | .39 | 89.54 | .36 | 4.332 |
| 6561 | Ralston Hominy Grits..... ... | 1.53 | 9.58 | .93 | .50 | 88.61 | .38 | 4.324 |
| 6581 | Nichol's Snow White Samp . ..... | 1.46 | 9.13 | .33 | .49 | 89.77 | .28 | 4.233 |
| 6579 | Cerealine Flakes ..... ..... | 1.54 | 9.61 | .60 | .40 | 88.86 | .53 | 4 333 |
| | OAT PREPARATIONS. | | | | | | | |
| 6563 | Banner Rolled Oats..... ..... | 3.12 | 19.50 | 7.38 | .97 | 70.05 | 2.10 | 4.688 |
| 6564 | Buckeye Rolled Oats ..... | 2.56 | 16.03 | 7.16 | 1.00 | 73.86 | 1.95 | 4.660 |
| 6553 | Hornby' Steam Cooked Oat Meal. | 2.84 | 17.74 | 7.76 | .93 | 71.59 | 1.98 | 4.690 |
| 6566 | McCann's Finest Oat Meal ..... | 2.57 | 16.04 | 8.90 | .86 | 72.04 | 2.16 | 4.702 |
| 6567 | Mother's Crushed Oats ..... | 2.77 | 17.30 | 7.79 | .72 | 72.10 | 2.09 | 4.715 |
| 6555 | Oatnuts Food. .. ..... | 2.75 | 17.20 | 8.35 | 1.02 | 71.38 | 2.05 | 4.703 |
| 6589 | Old Grist Mill Rolled Oats ..... | 2.61 | 16.31 | 8.37 | 1.03 | 72.21 | 2.08 | 4.695 |
| 6568 | Pillsbury's Flaked Oat Food..... | 2.35 | 14.71 | 7.64 | 1.30 | 74.48 | 1.87 | 4.666 |
| 6576 | Quaker Oats ..... | 2.78 | 17.38 | 8.57 | 1.06 | 71.18 | 1.81 | 4.722 |
| 6556 | Quaker Rolled White Oats ..... | 3.07 | 19.18 | 7.61 | 1.05 | 70.00 | 2.16 | 4.731 |
| 6557 | Ralston Health Oats. ..... | 3.06 | 19.10 | 7.67 | 1.03 | 70.01 | 2.19 | 4.709 |
| 6578 | Rob Roy Cut Oats..... .. | 2.54 | 15.90 | 7.51 | 1.03 | 73.43 | 2.13 | 4.696 |
| 6577 | Rob Roy Rolled Oats..... | 2.94 | 18.37 | 7.35 | 1.05 | 71.15 | 2.08 | 4.656 |
| 6716 | Saxon Rolled Oats ..... . ... | 3.08 | 19.26 | 7.81 | 1.14 | 69.28 | 2.51 | 4.723 |
| | WHEAT PREPARATIONS. | | | | | | | |
| 6543 | California Wheatine..... .... .. | 1.65 | 10.32 | 2.63 | 1.41 | 83.72 | 1.92 | 4.338 |
| 6544 | Cream of Wheat.. ..... ..... ... | 2.35 | 14.68 | 1.37 | .29 | 83.14 | .52 | 4.353 |
| 6545 | Fould's Wheat Germ Meal .... ... | 2.28 | 14.26 | 2.90 | 1.11 | 80.14 | 1.59 | 4.415 |
| 6570 | Fruen's Best Wheat Flakes ..... | 1.70 | 10.59 | 2.15 | 1.99 | 83.51 | 1.76 | 4.299 |
| 6583 | F S Parched Farinose..... .. ..... | 2.65 | 16.58 | 2.94 | 1.16 | 77.48 | 1.84 | 4.404 |
| 6584 | Germea ..... ..... | 1.60 | 9.98 | 1.36 | .32 | 87.73 | .61 | 4.292 |
| 6593 | Granose Biscuit..... | 2.14 | 13.39 | 1.71 | 1.13 | 80.88 | 2.89 | 4.297 |
| 6591 | Granose Flakes.... ... ..... | 1.97 | 12.34 | 1.16 | 2.21 | 81.07 | 3.22 | 4.217 |
| 6585 | Granula ..... ... ..... | 2.41 | 15.09 | 1.28 | 1.95 | 79.92 | 1.76 | 4.368 |
| 6546 | H-O Company's Breakfast Wheat | 1.78 | 11.13 | 1.07 | 1.77 | 84.17 | 1.85 | 4.281 |
| 6587 | Old Grist Mill Rolled Wheat ..... | 2.13 | 13.31 | 2.16 | 2.18 | 81.20 | 1.15 | 4.339 |
| 6588 | Old Grist Mill Toasted Wheat .... | 2.76 | 17.22 | 3.39 | 1.27 | 76.58 | 1.54 | 4.447 |
| 6548 | Pettijohn's Breakfast Food ..... | 2.10 | 13.16 | 2.48 | 2.32 | 80.43 | 1.61 | 4.418 |
| 6549 | Pillsbury's Vitos. ..... | 2.29 | 14.29 | 1.82 | .69 | 82.21 | .99 | 4.364 |
| 6550 | Ralston Health Breakfast Food .. | 2.06 | 12.87 | 1.63 | 1.09 | 83.20 | 1.21 | 4.281 |
| 6573 | Shredded Whole Wheat ..... | 2.03 | 12.67 | 1.41 | 2.45 | 82.05 | 1.42 | 4.403 |
| 6606 | Sugarnuts. .... ..... ..... | 2.67 | 13.55 | 2.27 | 1.42 | 81.12 | 1.64 | 4.489 |
| 6551 | Wheatena..... ... ..... ..... | 2.62 | 16.36 | 3.26 | 1.06 | 77.70 | 1.62 | 4.431 |
| 6552 | Wheatlet..... ..... | 2.38 | 14.89 | 2.45 | 1.18 | 80.17 | 1.31 | 4.378 |
| | MALTED FOODS. | | | | | | | |
| 6590 | Brittle Bits ..... ..... .... | 2.42 | 15.11 | .50 | 1.11 | 81.62 | 1.66 | 4.350 |
| 6569 | Force..... ..... | 1.96 | 12.22 | 1.43 | 2.19 | 81.19 | 2.97 | 4.177 |
| 6558 | Malt-Barley Breakfast Food ..... | 2.20 | 13.74 | 1.16 | .63 | 83.34 | 1.13 | 4.317 |
| 6547 | Malt Breakfast Food..... | 2.58 | 16.13 | 2.13 | .87 | 79.70 | 1.17 | 4.428 |
| 6554 | Malt-Oats Breakfast Food..... | 2.86 | 17.90 | 5.72 | .99 | 73.50 | 1.89 | 4.614 |
| | MISCELLANEOUS PREPARATIONS. | | | | | | | |
| 6562 | Cook's Flaked Rice ..... | 1.55 | 9.67 | .11 | .29 | 89.57 | .36 | 4.284 |
| 6574 | Cream of Cereals..... | 1.61 | 10.09 | 1.23 | .44 | 87.86 | .38 | 4.423 |
| 6575 | Grape-Nuts . ..... .. ... | 2.11 | 13.19 | 1.15 | 1.95 | 81.79 | 1.92 | 4.336 |
| 6559 | Ralston Health Barley Food.. .. | 1.94 | 12.11 | 1.14 | .72 | 84.87 | 1.16 | 4.306 |

WEIGHTS OF NUTRIENTS AND HEAT OF COMBUSTION OF ONE POUND OF CEREAL FOODS AS FOUND IN THE MARKET.

| Laboratory number. | Name of food. | Water. | Protein. | Fat. | Crude fiber. | Nitrogen-free extract. | Ash. | Heat of combustion per pound. |
|---|---|---|---|---|---|---|---|---|
| | CORN PREPARATIONS. | Lb. | Lb. | Lb. | Lb. | Lb. | Lb. | Cal. |
| 6580 | F S Granulated Hominy | .084 | .088 | .005 | .008 | .808 | .002 | 1747 |
| 6571 | Hecker's Hominy | .111 | .094 | .003 | .004 | .786 | .002 | 1732 |
| 6560 | H-O Co's New Process Hominy | .104 | .088 | .009 | .008 | .792 | .004 | 1751 |
| 6582 | Nichol's Pearl Hominy | .083 | .085 | .004 | .003 | .813 | .002 | 1745 |
| 6572 | Pierce's Hominy | .109 | .081 | .006 | .003 | .798 | .003 | 1751 |
| 6561 | Ralston Hominy Grits | .107 | .086 | .008 | .004 | .792 | .003 | 1753 |
| 6581 | Nichol's Snow White Samp | .103 | .082 | .003 | .004 | .805 | .003 | 1723 |
| 6579 | Cerealine Flakes | .096 | .087 | .005 | .004 | .803 | .005 | 1777 |
| | OAT PREPARATIONS. | | | | | | | |
| 6563 | Banner Rolled Oats | .077 | .180 | .068 | .009 | .647 | .019 | 1968 |
| 6564 | Buckeye Rolled Oats | .096 | .145 | .065 | .009 | .668 | .017 | 1912 |
| 6553 | Hornby's Steam Cooked Oat Meal | .084 | .163 | .071 | .008 | .656 | .018 | 1949 |
| 6566 | McCann's Finest Oat Meal | .077 | .148 | .082 | .008 | .665 | .020 | 1969 |
| 6567 | Mother's Crushed Oats | .082 | .159 | .071 | .007 | .662 | .019 | 1963 |
| 6555 | Oatnuts Food | .084 | .158 | .077 | .009 | .653 | .019 | 1953 |
| 6569 | Old Grist Mill Rolled Oats | .081 | .150 | .077 | .009 | .664 | .019 | 1958 |
| 6568 | Pillsbury's Flaked Oat Food | .086 | .135 | .070 | .012 | .680 | .017 | 1934 |
| 6576 | Quaker Oats | .078 | .177 | .070 | .010 | .645 | .020 | 1975 |
| 6556 | Quaker Rolled White Oats | .087 | .159 | .078 | .010 | .650 | .016 | 1960 |
| 6557 | Ralston Health Oats | .077 | .176 | .071 | .010 | .646 | .020 | 1971 |
| 6578 | Rob Roy Cut Oats | .091 | .167 | .067 | .010 | .646 | .019 | 1935 |
| 6577 | Rob Roy Rolled Oats | .084 | .146 | .069 | .009 | .672 | .020 | 1934 |
| 6716 | Saxon Rolled Oats | .097 | .174 | .071 | .010 | .625 | .023 | 1933 |
| | WHEAT PREPARATIONS. | | | | | | | |
| 6543 | California Wheatine | .091 | .094 | .024 | .013 | .761 | .017 | 1789 |
| 6544 | Cream of Wheat | .102 | .132 | .012 | .003 | .747 | .004 | 1774 |
| 6545 | Fould's Wheat Germ Meal | .102 | .128 | .026 | .010 | .720 | .014 | 1798 |
| 6570 | Fruen's Best Wheat Flakes | .097 | .096 | .019 | .018 | .754 | .016 | 1760 |
| 6583 | F S Parched Farinose | .080 | .153 | .027 | .011 | .712 | .017 | 1837 |
| 6584 | Germea | .098 | .090 | .012 | .003 | .791 | .006 | 1756 |
| 6593 | Granose Biscuit | .075 | .124 | .016 | .010 | .748 | .027 | 1803 |
| 6591 | Granose Flakes | .077 | .114 | .011 | .020 | .748 | .030 | 1765 |
| 6585 | Granula | .077 | .139 | .012 | .018 | .738 | .016 | 1880 |
| 6546 | H-O Co's Breakfast Wheat | .096 | .101 | .010 | .016 | .760 | .017 | 1755 |
| 6587 | Old Grist Mill Rolled Wheat | .088 | .121 | .020 | .020 | .740 | .011 | 1792 |
| 6588 | Old Grist Mill Toasted Wheat | .082 | .158 | .031 | .012 | .703 | .014 | 1852 |
| 6548 | Pettijohn's Breakfast Food | .097 | .119 | .022 | .021 | .726 | .015 | 1810 |
| 6549 | Pillsbury's Vitos | .086 | .131 | .017 | .006 | .751 | .009 | 1810 |
| 6550 | Ralston Health Breakfast Food | .091 | .117 | .015 | .010 | .756 | .011 | 1765 |
| 6573 | Shredded Whole Wheat | .073 | .117 | .013 | .023 | .761 | .013 | 1852 |
| 6606 | Sugarnuts | .119 | .119 | .020 | .012 | .715 | .015 | 1784 |
| 6551 | Wheatena | .079 | .151 | .030 | .010 | .715 | .015 | 1851 |
| 6552 | Wheatlet | .101 | .134 | .022 | .011 | .720 | .012 | 1793 |
| | MALTED FOODS. | | | | | | | |
| 6590 | Brittle Bits | .069 | .141 | .005 | .010 | .760 | .015 | 1837 |
| 6569 | Force | .054 | .116 | .014 | .020 | .768 | .028 | 1792 |
| 6558 | Malt-Barley Breakfast Food | .068 | .128 | .011 | .006 | .777 | .010 | 1826 |
| 6547 | Malt Breakfast Food | .086 | .147 | .019 | .008 | .729 | .011 | 1836 |
| 6554 | Malt-Oats Breakfast Food | .064 | .167 | .054 | .009 | .688 | .018 | 1959 |
| | MISCELLANEOUS PREPARATIONS. | | | | | | | |
| 6562 | Cook's Flaked Rice | .089 | .088 | .001 | .003 | .816 | .003 | 1770 |
| 6574 | Cream of Cereals | .108 | .090 | .011 | .004 | .784 | .003 | 1806 |
| 6575 | Grape-Nuts | .042 | .126 | .011 | .019 | .784 | .018 | 1854 |
| 6559 | Ralston Health Barley Food | .108 | .107 | .010 | .006 | .758 | .010 | 1744 |

## AMOUNTS OF NUTRIENTS FURNISHED FOR TEN CENTS IN CEREAL FOODS AT ORDINARY PRICES.

| Name of Food. | Prices per pound. | TEN CENTS WILL PAY FOR— | | | | | Heat of combustion. |
|---|---|---|---|---|---|---|---|
| | | Total food materials. | Nutrients. | | | | |
| | | | Total. | Protein. | Fats. | Carbohydrates. | |
| **CORN PREPARATIONS.** | Cts. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Cal. |
| F S Granulated Hominy | 9.2 | 1.09 | .99 | .10 | .01 | .88 | 1903 |
| Hecker's Hominy | 5.0 | 2.00 | 1.77 | .19 | .01 | 1.57 | 3464 |
| H-O Company's New Process Hominy | 5.0 | 2.00 | 1.78 | .18 | .02 | 1.58 | 3502 |
| Nichols' Pearl Hominy | 4.5 | 2.22 | 2.00 | .19 | .01 | 1.80 | 3873 |
| Pierce's Hominy | 5.0 | 2.00 | 1.77 | .16 | .01 | 1.60 | 3502 |
| Ralston Hominy Grits | 5.5 | 1.82 | 1.61 | .15 | .02 | 1.44 | 3190 |
| Nichols' Snow White Samp | 2.1 | 4.76 | 4.23 | .39 | .01 | 3.84 | 8200 |
| Cerealine Flakes | 9.1 | 1.10 | .99 | .10 | .01 | .88 | 1955 |
| **OAT PREPARATIONS.** | | | | | | | |
| Banner Rolled Oats | 5.8 | 1.73 | 1.55 | .31 | .12 | 1.12 | 3397 |
| Buckeye Rolled Oats | 5.1 | 1.96 | 1.72 | .28 | .13 | 1.31 | 3747 |
| Hornby'y Steam Cooked Oat Meal | 7.8 | 1.28 | 1.14 | .21 | .09 | .84 | 2495 |
| McCann's Finest Oat Meal | 10.9 | .92 | .83 | .14 | .08 | .61 | 1812 |
| Mother's Crushed Oats | 7.1 | 1.41 | 1.27 | .22 | .10 | .95 | 2768 |
| Oatnuts Food | 5.7 | 1.75 | 1.55 | .28 | .13 | 1.14 | 3417 |
| Old Grist Mill Rolled Oats | 5.5 | 1.82 | 1.62 | .27 | .14 | 1.21 | 3564 |
| Pillsbury's Flaked Oat Food | 5.3 | 1.89 | 1.68 | .26 | .13 | 1.29 | 3656 |
| Quaker Oats | 3.1 | 3.23 | 2.88 | .57 | .23 | 2.08 | 6380 |
| Quaker Rolled White Oats | 6.3 | 1.59 | 1.41 | .25 | .13 | 1.03 | 3117 |
| Ralston Health Oats | 5.8 | 1.73 | 1.54 | .30 | .12 | 1.12 | 3409 |
| Rob Roy Cut Oats | 5.0 | 2.00 | 1.76 | .34 | .13 | 1.29 | 3871 |
| Rob Roy Rolled Oats | 5.0 | 2.00 | 1.77 | .29 | .14 | 1.34 | 3868 |
| Saxon Rolled Oats | 5.7 | 1.75 | 1.51 | .30 | .12 | 1.09 | 3382 |
| **WHEAT PREPARATIONS.** | | | | | | | |
| California Wheatine | 7.9 | 1.27 | 1.12 | .12 | .03 | .97 | 2272 |
| Cream of Wheat | 8.8 | 1.14 | 1.01 | .15 | .01 | .85 | 2023 |
| Fould's Wheat Germ Meal | 7.3 | 1.37 | 1.20 | .17 | .04 | .99 | 2464 |
| Fruen's Best Wheat Flaked | 7.1 | 1.41 | 1.22 | .13 | .03 | 1.06 | 2482 |
| F S Parched Farinose | 6.0 | 1.67 | 1.49 | .25 | .05 | 1.19 | 3069 |
| Germea | 8.3 | 1.21 | 1.08 | .11 | .01 | .96 | 2125 |
| Granose Biscuit | 18.6 | .54 | .48 | .07 | .01 | .40 | 973 |
| Granose Flakes | 22.4 | .45 | .39 | .05 | – | .34 | 794 |
| Granula | 27.2 | .37 | .33 | .05 | – | .28 | 677 |
| H-O Company's Breakfast Wheat | 9.8 | 1.02 | .89 | .10 | .01 | .78 | 1790 |
| Old Grist Mill Rolled Wheat | 6.1 | 1.64 | 1.44 | .20 | .03 | 1.21 | 2942 |
| Old Grist Mill Toasted Wheat | 8.8 | 1.14 | 1.02 | .18 | .04 | .80 | 2111 |
| Pettijohn's Breakfast Food | 7.0 | 1.43 | 1.24 | .17 | .03 | 1.04 | 2587 |
| Pillsbury's Vitos | 6.4 | 1.56 | 1.40 | .20 | .03 | 1.17 | 2824 |
| Ralston Health Breakfast food | 7.2 | 1.39 | 1.23 | .16 | .02 | 1.05 | 2452 |
| Shredded Whole Wheat | 15.0 | .67 | .60 | .08 | .01 | .51 | 1213 |
| Sugarnuts | 5.0 | 2.00 | 1.71 | .24 | .04 | 1.43 | 3588 |
| Wheatena | 10.7 | .93 | .83 | .14 | .03 | .66 | 1722 |
| Wheatlet | 6.8 | 1.47 | 1.29 | .20 | .03 | 1.06 | 2636 |
| **MALTED FOODS.** | | | | | | | |
| Brittle Bits | 12.5 | .80 | .72 | .11 | – | .61 | 1469 |
| Force | 16.5 | .67 | .60 | .08 | .01 | .51 | 1201 |
| Malt-Barley Breakfast Food | 10.0 | 1.00 | .92 | .13 | .01 | .78 | 1826 |
| Malt Breakfast Food | 9.4 | 1.06 | .95 | .16 | .02 | .77 | 1947 |
| Malt-Oats Breakfast Food | 9.6 | 1.04 | .95 | .17 | .06 | .72 | 2037 |
| **MISCELLANEONS PREPARATION.** | | | | | | | |
| Cook's Flaked Rice | 18.2 | .55 | .50 | .05 | – | .45 | 974 |
| Cream of Cereals | 7.9 | 1.26 | 1.11 | .11 | .01 | .99 | 2254 |
| Grape-Nuts | 14.6 | .69 | .64 | .09 | .01 | .54 | 1300 |
| Ralston Health Barley Food | 6.9 | 1.45 | 1.27 | .16 | .01 | 1.10 | 2529 |

## PREPARED CEREALS.

While hominy has long been in use in certain sections of the country, the general introduction of cereal breakfast foods is comparatively recent. Oat meal is a favorite dish with the Scotch and Irish and its adoption has naturally followed the immigration of these races. Formerly both preparations were coarsely ground and required prolonged cooking. The first great advance along this line was the manufacture of rolled oats, a process which consists in softening the kernel by steaming, after which it is passed between steel rollers and dried. The resulting article was found not only to keep well, but, being partially cooked, and the cell walls ruptured by the crushing process to which it was subjected, the time required in preparing it for the table was very materially shortened. Later the same process was applied to wheat, rice and corn, yielding products which are adapted not only for breakfast foods but also for the preparation of puddings and other desserts. To-day the excellence and variety of the cereal foods should excite the gratitude of the housewife, whose chief embarrassment lies in choosing among the many. It is in the hope of assisting in this choice that this bulletin is written.

All the samples collected for analysis were guaranteed fresh goods by the dealer from whom they were purchased. In spite of this precaution a number of packages when opened were found not only musty but infested with moths or the larvæ of beetles. All such samples were rejected as not fairly representing the goods. Some method should be devised whereby such stale goods should be withdrawn from the market or replaced by fresh preparations. The interests of both manufacturers and dealers would seem to demand that the consumer should have a reasonable assurance as to the quality of the goods purchased.

Of the fifty brands recently collected only twenty-one are found in the list of those collected three years ago. There seems to be a tendency on the part of the manufacturers to substitute new and attractive names for a product that has been before the public for some time.

## DISCUSSION.

It is unnecessary to explain at length the terms employed in this discussion. It may be remarked that protein occupies an especially important place among the nutrients, since it can, to a certain extent, replace the fats and carbohydrates, while neither of the latter can replace the protein. Since the foods rich in protein are among the most expensive, it will be readily seen why the percentage of nitrogen present should be considered as of prime importance.

The amount of crude fiber or woody matter present gives us some clue as to the extent to which the outer covering of the grain has been removed. Thus, the whole (undecorticated) wheat kernel contains about 2.40 per cent of crude fiber, all of which remains in graham flour. The so-called entire wheat flour, of which the Franklin Mills flour is an example, is from the decorticated kernel, and contains from .80 to 1.00 per cent of crude fiber. In the manufacture of ordinary white flour, not only the outer coatings of the wheat kernel are removed, but the inner envelopes as well, leaving only from .20 to .40 per cent of crude fiber in the finished product. In the discussion which follows, the term "decorticated grain" will be used to signify the grain from which the outer coatings only have been removed.

The methods of analysis employed are those in general use. The heats of combustion were determined by the use of Atwater's bomb calorimeter.

## CORN PREPARATIONS.

The 8 samples of hominy and samp examined agree as closely in composition as could be expected. The differences in fat content are probably due to varying amounts of the chit or germ left in the process of manufacture. The Cerealine Flakes differ from the other corn preparations in that they have been previously cooked and require but little additional cooking to fit them for use, while the hominy and samp require long cooking.

Of the 8 corn preparations examined, 5 show as little variation in cost as in composition, the prices ranging from 4½ to 5½ cents per pound. The method of preparing the Cerealine Flakes may, perhaps justify an increased price, but why F S Granulated Hominy should sell at 9.2 cents per pound and Nichol's Pearl Hominy at less than one-half that amount is not evident.

A study of the table on page 138 is recommended in this connection. It will be seen there also that in the form of Nichol's Snow White Samp at 10 cents per package, 10 cents will buy more than double the nutrients to be found at the same price in any other of these corn products.

### OAT MEALS.

The analyses of 14 different brands of oat preparations are here reported. It is worthy of note that they average considerably higher in protein (16.00 per cent) than did the 14 similar preparations examined in 1899 (15.00 per cent). It is well known that the quality of the cereals vary somewhat from year to year according to the character of the growing season, and this improvement in composition is probably due to such natural causes rather than to more careful selection on the part of manufacturers or improved methods of preparation. The Banner, the Quaker and the Ralston Health Oats carry about 18 per cent of protein and the Saxon Rolled Oats over 17 per cent. The Rob Roy Cut Oats contain 16.7 per cent of protein, against 14.6 per cent for the Rob Roy Rolled Oats. Pillsbury's Flaked Oat Food was the lowest in protein (13.5 per cent) of the samples examined and was also the highest in woody fiber. The oat foods were all of good quality and bear evidence of careful preparation. The differences between them are perhaps no greater than might be expected. It is probable that the goods of different companies vary no more in composition than different samples from the same company might. For example, Hornby's Oat Meal, which in 1899 carried 13.4 per cent of protein, in 1902 carries 16.3 per cent.

For the most part the packages containing the oat preparations are free from misleading statements. The manufacturers of the Banner Oats and Saxon Oats are evidently attempting to push their sale by the "elegant piece of decorated china" enclosed in each package. It happens that the Banner Oats carry more protein than any other brand examined, while the Saxon Oats are far above the average in this respect; but this is probably accidental, as there is no reason to suppose that the American Cereal Company is making a more careful selection of oats in these goods than in the Quaker or Buckeye brands.

Hornby's H-O Oat Meal carries a guarantee that the quality of the product contained in the package is *superior* to that of any similar article. It has the composition of an average oat meal and in flavor and appearance is similar to others. It is probable, however, that the guarantee deceives but few. While the package of Hornby's Oat-Meal carried no very misleading statements, the following was taken from a package of Hornby's H-O Wheat: "Hornby's Oat-Meal is prepared by its own peculiar process under our patents so that every grain is prepared for easy digestion, making one package of more nutritive value than three packages of ordinary oat meal." While there is no doubt as to the good quality of Hornby's Oat-Meal, its chemical composition does not show it to be superior to other well made oat meals. On the other hand, its cost per pound is 25 per cent above the average and with but one exception higher than that of any other oat food here given.

The Liberty Pure Food Company claims for Oatnuts Food that "after many years experimenting we have succeeded in separating the meat of the oat from the shell, thus making Oatnuts; something heretofore found to be impossible." As Oatnuts Food has about the average amount of crude fiber, there is no evidence that the company has been more successful in "separating the meat from the shell" than other companies.

From the cost table on page 138 we find an interesting variation in the prices of these goods. One article purchased in bulk costs but 3.1 cents per pound, while the average cost is about 6.1 cents. An imported brand, put up in tin boxes, sells for 10.9 cents per pound, or nearly double the average price. This sample contained over one per cent less protein than the average oat preparation, but yielded an excessive amount of fat. It is possible that some reason exists why certain of these goods should sell for a higher price than others, but it is rarely possible to trace any relation between the cost and the actual nutritive value.

### WHEAT PREPARATIONS.

Nineteen different samples of wheat preparations have been examined, 7 of which carry more than 13 per cent of protein, while 4 have from 9 to 10 per cent of protein. If one may judge from the analyses, the tendency has been to use stronger wheats than formerly in these preparations. A possible explanation of

the high protein content may be found in the fact that during the later part of the last grain growing season a severe drouth prevailed in the wheat districts, thus preventing the storage of starch in the berry and giving grain unusually high in protein.

"California Wheatine is made of first quality California white wheat, known the world over for its excellent flavor, sweetness, richness in nutritive qualities, particularly its large per cent of gluten." The California wheats do not carry large amounts of gluten as is illustrated by the low protein content (9.38 per cent) of this sample. Only one other of the 19 wheat foods examined carried as little protein as this. From the amounts of crude fiber and ash present, California Wheatine is probably prepared from more or less imperfectly decorticated wheat.

The manufacturers of Cream of Wheat continue to make the same claim as in 1899. The comments which follow, made in Bulletin 55 of this Station, are still true. "The claim that Cream of Wheat is almost pure gluten is false and should be criminal. As a food for people in health, Cream of Wheat is all right. Diabetic persons should avoid starch and sugar, and this preparation contains 75 per cent of these carbohydrates." In composition it closely resembles a good bread flour.

Fould's Wheat Germ Meal is said to be made from the glutenous portion of choice wheat. "Gluten of Wheat. Superior to oat meal." These statements are evidently intended to carry the impression that the starchy portions of the kernel are excluded, although the claim that it is "the best thing for thickening soup" must be based upon its high starch content and not upon a large amount of gluten. Its chemical composition indicates that it is prepared from decorticated wheat of average composition.

Fruen's Best Wheat Flakes, "made from the best Pacific Coast White Wheat," claims to be "the great nerve, brain and muscle food," "the indigestible matter being entirely removed." The claims are, of course, exaggerated, for Fruen's Wheat Flakes contain 1.8 per cent of woody fiber, which is indigestible. Its chemical composition indicates that it is made from a soft white wheat. From its high per cent of fiber and ash it seems doubtful if any considerable amount of the outer coatings have been removed in its preparation.

F S Parched Farinose, made by the American Cereal Company, "from Ohio's Best Amber Wheat," is among the highest

in protein of any of the samples examined. The claims, "rich in Gluten, Germ, Nitrates, Fat and Phosphates," certainly need editing. Fortunately for the users it contains no nitrates. It is evidently prepared from a hard wheat which has been decorticated. The low cost and high protein content of Farinose make it one of the most economical of the wheat preparations.

Germea "is California White Wheat, the skin peeled off, and the rest of the kernel (including germ and gluten) ground coarse." The sample was much lower in protein (9 per cent) than that examined in 1899 (12.90 per cent). The low per cent of crude fiber (.30 per cent) and ash (.55 per cent) shows that in the process of manufacture a good deal of the outer coating of the berry is removed, the product approaching common flour in composition.

Granose Biscuit and Granose Flakes, although very different in appearance, are put up by the same company and are so much alike in chemical composition that they may be considered together, the chief difference being in the amounts of fats and crude fiber which they contain. The composition of Granose Biscuit is very nearly that of a decorticated wheat, except in the high ash content, which is probably due to the presence of common salt. The Granose Flakes resemble more closely an undecorticated wheat, though somewhat deficient in fat and with an excess of ash, probably due to the addition of salt.

The fact that these goods, in spite of their high cost, seem to meet with a ready sale demonstrates the business value of judicious advertising and proves that the public is willing to pay a generous price for an attractive article. Reference to the table on page 138 shows that 10 cents will purchase only about half a pound of Granose Biscuit, having an energy-producing value of 973 calories. Granose Flakes cost 22.4 cents per pound and 10 cents pays for less than 800 calories. The same amount of money expended for flour would buy eight times as much protein and nearly seven times as much energy-producing value. We should not, however, lose sight of the fact that Granose Biscuit and Granose Flakes are ready cooked and appetizing. Whether the average consumer can afford to pay the price asked for these goods is a question that can only be answered by the individual.

Granula. "Prepared by a peculiar process original with us, embracing the use of all the constituents of the grain, which is

the best white winter wheat, grown in the famous Genesee Valley country." The manufacturers state that it is "one of the cheapest foods in use, a pound of it containing more absolute nutriment for brain and body than an equal weight of any preparation in the market." It is evidently made from a high grade hard wheat of a high protein content.

While the analyses of Granula shows it to be superior to the average wheat preparation, its price flatly contradicts the claim of cheapness. A package of these goods, containing about nine-tenths of a pound, costs 25 cents, or 27.2 cents per pound. In composition it is but slightly superior to a good flour to be had at one-tenth of the price. Reference to the table on page 138 shows that no other cereal food named in this bulletin furnishes so little nutriment for the money.

The H-O Company's Breakfast Wheat carries about 10 per cent of protein, which indicates that a soft wheat low in protein was used in its preparation. Its high fiber and ash content would indicate that it is made from undecorticated wheat.

Old Grist Mill Rolled Wheat "is prepared from the finest California White Wheat." This preparation is low in ash as compared with the crude fiber which it carries. Its percentage of protein (12.1) shows that it is made from wheat of average composition. The claim that "it is not heating to the blood" is certainly fanciful, since it has practically the same heat of combustion as the other wheat and oat products. At the price paid it compares favorably with the other foods of this class, only two of which furnish as much nutriment for the money.

Old Grist Mill Toasted Wheat. Its ash and crude fiber content would indicate that it is made from a partially decorticated wheat. The claim that it is healthful and nutritious is true of this preparation as well as of the others here reported. In its protein and fat content it ranks higher than any other of the wheat preparations examined.

Pettijohn's Breakfast Food "is made from selected Pacific coast wheat." In its preparation "the hull or covering or woody matter is entirely removed, leaving only that part of the grain containing nutritious qualities, so valuable in building up the muscles of the system, and the phosphatic matter most valuable as a nerve and brain tonic, as it is entirely free from bran." The latter statement is hardly borne out by the analysis which shows

2.1 per cent of crude fiber, practically that of the average California undecorticated wheat and higher than that of any other wheat preparation here reported, except the Shredded Whole Wheat. Its protein, fiber and ash content agree with those of undecorticated wheat.

Pillsbury's Vitos. "It is the choicest product of carefully selected northwestern hard spring wheat." This sample is higher in both ash and protein than that examined three years ago. The ash and crude fiber indicate that it is made from decorticated wheat. At 13 cents a package it is one of the cheapest of these foods.

Ralston Health Breakfast Food. The writer of the advertisement printed on the package evidently mistakes starch for gluten in explaining how one part of this food can absorb six parts of water. The amount of protein is somewhat below the average. Its crude fiber and ash indicate that it is made from decorticated wheat.

Shredded Whole Wheat "consists of the whole wheat berry, (nothing added), made light and short by a mechanical shredding and thorough cooking." Its chemical composition is that of a rather soft wheat. It is interesting to note that this most extensively advertised of wheat preparations carries no advertising statements of an exaggerated nature. While the advertisement is written with the evident intention of convincing the reader that there is no other wheat product to be compared with this, a careful inspection of the package fails to disclose any statements to which exceptions can be taken. It has the same nutritive value as the wheat from which it is made. Shredded Wheat at 13 cents a package costs 15 cents per pound and is consequently somewhat expensive, though it should not be forgotten that it is cooked and ready for the table.

Sugarnuts. "This food is made from the germ and glutinous portions of Aroostook wheat. As the germ is large and fully developed in the wheat grown in this section the food contains a large portion of the germ, giving that sweet and nutty flavor peculiar to Aroostook Wheat flour." It is sold in bulk at 5 cents a pound and is by far the cheapest of the wheat preparations named here. As it is uncooked it is not quite so quickly prepared for the table as some of the cereal foods.

Wheatena is made from "peeled wheat." "As it is deficient in starch, the dyspeptic, with whom starch is indigestible, finds

comfort from its use." As a matter of fact, the nitrogen-free extract, which includes the starch, is the same as that of any wheat products carrying an equal amount of protein (15.06 per cent). Its richness in the latter constituent is more than offset by its price, 10.7 cents per pound, which places it among the less economical foods of this class.

Wheatlet is apparently made from a good grade decorticated wheat. The claim that it is "exceptionally rich in the nitrogenous and phosphatic food elements" is true of Wheatlet only in the same sense that it is true of any other of the wheat preparations.

## MALTED FOODS.

Starch, which makes up by far the greater part of the cereal grains, must be converted into soluble forms before it can be absorbed and made of use to the animal body. By the action of the saliva, and to a greater extent by the pancreatic juice, starch is changed to dextrin and maltose, which last is, at least in part, changed to dextrose or glucose, in which form it may be absorbed. Just so much of the starch as escapes this solvent action is lost as food. While raw starch is not easily digested by man, cooked starch in reasonable quantities offers no difficulty to the healthy individual. With many persons of weak digestion the starch of the food, even when properly cooked, is not well digested. Any process, therefore, which accomplishes the solvent action noted above either wholly or in part, to that extent relieves the digestive organs, and the food is, so far as the starch is concerned, "predigested."

In the germination of cereals the starch is rendered soluble by the action of a ferment known as diastase, which nature seems to have provided for that purpose. This ferment is able to convert into maltose not only the starch of the kernel in which it is formed, but a much larger amount as well. If barley be sprouted and the germination arrested before the sprout has reached any considerable length, a product known as *malt* is formed. When the malt is ground and mixed with a large amount of grain, the mass moistened and kept at a suitable temperature, the starch, not only of the malt, but of the unsprouted grain also, is converted into maltose.

The manufacturers of malt foods claim that a considerable portion of the starch of their products has thus been acted upon,

and there seems no reason to doubt the truth of the assertion. Since a long continued fermentative process would be likely to produce undesirable flavor, it is probable that a large part of the starch is still unacted on. The action can go on only when the cereal is moist and warm and must cease when the product is cooked, as ferments are destroyed by boiling. It is needless to say that the average person should not depend upon predigested foods.

Brittle Bits, "a soluble, sterilized, predigested food scientifically prepared from entire wheat and barley, producing that delicate malt flavor." "It is ready to be absorbed the moment it is put into the stomach." "One pound of lean beef gives 447 calories of heat units, while one pound of Brittle Bits gives about 1870 calories or heat units, therefore one pound of Brittle Bits is equal to four pounds of beef steak." While the latter statement is not far from the truth, it is too misleading to pass unchallenged. If fat beefsteak had been chosen for comparison it would have been found equal to Brittle Bits in the number of calories yielded. Fat yields more than twice as many calories as an equal weight of protein; yet the protein is by far the more valuable nutrient, costing more, and more essential. If Brittle Bits is compared with lean beef on the protein basis, we find that while the cereal food carries 14 per cent of protein, the meat carries about 23 per cent, or one and two-thirds times as much. It should be added that a food that "requires no effort on the part of the salivary or pancreatic glands to digest it, and makes it fit for assimilation," is not well adapted for a person in health. Nature gave us salivary and pancreatic glands and intended that they should be used.

Force. "A simple preparation of the whole of the wheat and barley malt." "With Force the work of digestion is already half done. It slips into the tissues and makes bone and muscles almost as soon as eaten." The analysis given on the package agrees quite closely with that obtained at this laboratory.

### MISCELLANEOUS PREPARATIONS.

Cook's Flaked Rice, "made from Louisiana and Texas rice." It has practically the same composition as raw rice, but is cooked and quickly prepared for use. Rice is lower in protein than

wheat and oats, in its composition more nearly resembling Indian corn. The statement "Flaked Rice stands at the head of all foods as a tissue builder" is not supported by its chemical composition. The following assertions are printed upon the package:

"Flaked Rice contains 87 per cent nutriment.
Beef " 45 " "
Potatoes " 21 " "

One pound Flaked Rice contains 21 per cent more life-giving nourishment than a pound of beef and a pound of potatoes combined."

So far as the total "nutriment" is concerned, the claim of the manufacturers might have been put more strongly. Whatever force the statement possesses lies in placing an equal valuation upon the various nutrients that are here classed together as "nutriment." Since the protein, as shown elsewhere, costs more than the other nutrients, the value of a food must depend more upon this than upon any other single constituent. The combined meat and potato contain two and one-half times the amount of protein found in the rice, a fact which more than off-sets the advantage claimed by the advertisers.

Grape-Nuts, "made by special treatment of entire wheat and barley." The statement formerly made, that "4 heaping teaspoons of Grape-Nuts are sufficient for the average meal," is now modified to read, "for the cereal part of a meal." The manufacturers still persist, however, in saying that "the system will absorb a greater amount of nourishment from 1 pound of Grape-Nuts than from 10 pounds of meat, wheat, oats or bread." The following from Bulletin 55 of this Station, pp. 103-4, shows the absurdity of this statement:

A man at moderate work needs per day about .28 pounds of protein and sufficient fats and carbohydrates in addition to make the potential energy of the day's food 3,500 calories. Four heaping teaspoonfuls of Grape-Nuts weigh about 1 ounce. The protein and energy needed for one meal (1-3 of 1 day) and that furnished by 4 heaping teaspoonfuls of Grape-Nuts are compared in the following table:

| | Protein —lbs. | Fuel value —calories. |
|---|---|---|
| Needed for ⅓ day by man at moderate work | .090 | 1,175 |
| Furnished by four heaping teaspoonfuls (1 oz.) of Grape Nuts | .007 | 117 |

It would require .77 pounds of Grape Nuts (¾ of a package) to furnish ⅓ of the protein needed for one day for a man at moderate work; the energy needed would be afforded by .63 pounds.

The nutrients of beef are more completely digested and absorbed than those of vegetable foods. There is no reason for thinking that Grape Nuts would be more completely digested than rolled oats, wheat flour or wheat bread. About 85 per cent of the protein and of fuel value of vegetable foods are digested and rendered available to the body.

In the following table there are compared the pounds of protein and fuel values of one pound of Grape Nuts with "ten pounds of meat, wheat, oats or bread."

POUNDS OF PROTEIN AND FUEL VALUE OF ONE POUND OF GRAPE NUTS COMPARED WITH 10 POUNDS OF BEEF, ROLLED WHEAT, WHEAT FLOUR, ROLLED OATS AND BREAD.

| | Protein —lbs. | Fuel value —calories. |
|---|---|---|
| 1 pound of Grape Nuts | .12 | 1,870 |
| 10 pounds round steak, inciuding bone, | 1.90 | 8,950 |
| 10 pounds beef rump, including bone | 1.29 | 14,050 |
| 10 pounds rolled wheat | 1.01 | 17,650 |
| 10 pounds bread flour | 1.31 | 16,450 |
| 10 pounds rolled oats | 1.50 | 19,650 |
| 10 pounds white bread | .80 | 12,200 |

## CONCLUSION.

The average percentage composition of the three chief classes of these foods is shown in the following condensed table:

| Class of foods. | Number of samples. | Water. | Protein. | Fat. | Crude fiber. | N-free extract. | Ash. | Heat of combustion—calories per pound. |
|---|---|---|---|---|---|---|---|---|
| | | Per ct. | Per ct. | Per ct. | Per ct. | Per ct. | Per ct | Cal. |
| Corn | 8 | 10.2 | 8.7 | .6 | .3 | 79.9 | .3 | 1750 |
| Oats | 14 | 8.4 | 16.0 | 7.2 | .9 | 65.6 | 1.9 | 1850 |
| Wheat | 19 | 9.0 | 12.4 | 1.9 | 1.3 | 73.9 | 1.5 | 1800 |

If these figures be compared with those on page 130, a considerable variation will be noticed, due in part to a difference in the original grains and in part to the methods of manufacture. The fat of the corn kernel is mostly included in the germ which is removed in the manufacture of hominy, thus greatly reducing the fat content. In both cases, however, the three grains, corn, oats and wheat, will be found to stand in the same relation to one another, the oats carrying the most protein, fat, and ash, and yielding the greatest amount of energy per pound. Corn ranks far below oats in these respects, while wheat occupies an intermediate position. The amount of nitrogen-free extract is in inverse ratio to these other constituents.

If we study the above table in connection with the average cost per pound of these three classes of cereal foods, remembering at the same time that the protein is the most valuable of the nutrients, we are left in no doubt as to their relative economy. The average price per pound was:

Corn preparations ..... 5.7 cents
Oat preparations ..... 6.0 cents
Wheat preparations (omitting 4 extreme cases) 10.6 cents

In conclusion, it should be repeated that all the cereal foods examined were good articles and the average prices as a rule are not exorbitant. On the contrary, when compared with the meats and vegetables, the most of them must be classed as very economical foods. The prices are exceedingly variable and, so far as ordinary chemical analysis shows, furnish no measure of the value of the goods. On the other hand, while

their comparative digestibility has not yet been well worked out, there can be no doubt that the attempts to increase the digestibility of some of these goods by special treatment has been successful and persons of weak digestion would find it to their advantage to base their selection upon other data than that here given. Fortunately the invalids are still in the minority; and the average consumer, who will experience no difficulty with any of these foods, is not justified in paying 20 cents per pound for a cereal preparation when another, that will serve his purpose exactly as well, can be had at 5 or 6 cents.

# FERTILIZER INSPECTION.

CHAS. D. WOODS, Director.

J. M. BARTLETT, Chemist in charge of Fertilier Analysis.

The law regulating the sale of commercial fertilizers in this State calls for two bulletins each year. The first of these contains the analyses of the samples received from the manufacturer guaranteed to represent, within reasonable limits, the goods to be placed upon the market later. The second bulletin contains the analyses of the samples collected in the open market by a representative of the Station.

The analyses of the manufacturer's samples for this year were published early in March. The present bulletin contains the analyses of the samples collected by the representative of the Director of the Station.

The figures which are given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the guarantee. If, for instance, the guarantee is 2 to 3 per cent of nitrogen, it is evident that the dealer cannot be held to have agreed to furnish more than two per cent and so this percentage is taken as actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples.

A comparison of the results of the analyses of the samples collected by the Station with the percentages guaranteed by the manufacturers shows that, as a rule, the fertilizers sold in the State are well up to the guarantee. In a few instances the particular lots of fertilizers sampled are not quite as good as they should be; there is, however, no case which appears to be an attempt to defraud. The comparisons indicate that the manufacturers do not intend to do much more than make good the minimum guarantee and this is all that the purchaser can safely expect.

## DESCRIPTIVE LIST OF STATION SAMPLES, 1902.

| Station number. | Manufacturer, place of business and brand. | Sampled at |
|---|---|---|
| | THE AMERICAN AGR. CHEM. CO., N. Y. | |
| 2813 | Bradley's Complete Manure for Potatoes and Vegetables | Bangor |
| 2814 | Bradley's Complete Manure with 10% Potash | Houlton |
| 2815 | Bradley's Corn Phosphate | Bangor |
| 2816 | Bradley's Eureka Fertilizer | Bangor |
| 2817 | Bradley's Niagara Phosphate | Portland |
| 2818 | Bradley's Potato Fertilizer | Bangor |
| 2819 | Bradley's Potato Manure | Bangor |
| 2820 | Bradley's X. L. Superphosphate | Bangor |
| 2821 | Clark's Cove Bay State Fertilizer | Belfast |
| 2822 | Clark's Cove Bay State Fertilizer G. G. | Portland |
| 2823 | Clark's Cove Bay State Fertilizer for Seeding Down | Portland |
| 2824 | Clark's Cove Defiance Complete Manure | Portland |
| 2825 | Clark's Cove Great Planet Manure A. A. | Portland |
| 2826 | Clark's Cove King Philip Alkaline Guano | Portland |
| 2827 | Clark's Cove Potato Manure | Portland |
| 2828 | Cleveland Fertilizer for All Crops | Portland |
| 2829 | Cleveland High Grade Complete Manure | Bangor |
| 2830 | Cleveland Potato Phosphate | Portland |
| 2831 | Cleveland Seeding Down Fertilizer | Portland |
| 2832 | Cleveland Superphosphate | Portland |
| 2833 | Crocker's Corn Phosphate | Portland |
| 2834 | Crocker's Grass and Oat Fertilizer | Portland |
| 2835 | Crocker's Rival Ammoniated Superphosphate | No. Carmel |
| 2836 | Crocker's Potato, Hop and Tobacco Phosphate | Portland |
| 2837 | Crocker's Special Potato Manure | Presque Isle |
| 2838 | Crocker's Superior Phosphate | Bangor |
| 2839 | Cumberland Guano for All Crops | Bangor |
| 2840 | Cumberland Potato Fertilizer | Ea. Corinth |
| 2841 | Cumberland Seeding Down Manure | Portland |
| 2842 | Cumberland Superphosphate | Portland |
| 2843 | Darling's Blood, Bone and Potash | Caribou |
| 2844 | Great Eastern General Fertilizer | Old Town |
| 2845 | Great Eastern Grass and Oat Fertilizer | Old Town |
| 2846 | Great Eastern High Grade Special Potato Manure | Caribou |
| 2847 | Great Eastern Potato Manure | Old Town |
| 2848 | Great Eastern Northern Corn Special | Carmel |
| 2849 | Otis Potato Fertilizer | So. Windham |
| 2850 | Otis Superphosphate | So. Windham |
| 2851 | Pacific Dissolved Bone and Potash | Portland |
| 2852 | Pacific Grass and Grain Fertilizer | Belfast |
| 2853 | Pacific High Grade General Fertilizer | Belfast |
| 2854 | Pacific Nobsque Guano | Portland |

ANALYSES OF STATION SAMPLES, 1902.

| Station number. | Nitrogen. | | | | Phosphoric Acid. | | | | | | | Potash. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soluble in water. | Insoluble in water. | Total. | | Soluble. | Reverted. | Insoluble. | Available. | | Total. | | Found. | Guaranteed. |
| | | | Found. | Guaranteed. | | | | Found. | Guaranteed. | Found. | Guaranteed. | | |
| | % | % | % | % | % | % | % | % | % | % | % | % | % |
| 2813 | 2.27 | 1.24 | 3.51 | 3.30 | 5.34 | 3.18 | 1.80 | 8.52 | 8 | 10.32 | 9 | 7.90 | 7 |
| 2814 | 1.18 | 2.12 | 3.30 | 3.30 | 3.03 | 3.36 | 2.25 | 6.39 | 6 | 8.64 | 7 | 10.07 | 10 |
| 2815 | 1.10 | 1.08 | 2.18 | 2.06 | 5.74 | 3.19 | 2.14 | 8.93 | 8 | 11.07 | 10 | 1.91 | 1.50 |
| 2816 | .72 | .64 | 1.36 | 1.03 | 4.86 | 4.54 | 2.16 | 9.40 | 8 | 11.56 | 10 | 2.08 | 2 |
| 2817 | .71 | .64 | 1.35 | .82 | 3.08 | 4.07 | 2.83 | 7.15 | 7 | 9.98 | 8 | 1.23 | 1 |
| 2818 | .74 | 1.36 | 2.10 | 2.06 | 6.30 | 2.68 | 2.41 | 8.98 | 8 | 11.39 | 10 | 2.76 | 3 |
| 2819 | 1.19 | 1.36 | 2.55 | 2.50 | 3.92 | 3.73 | 3.24 | 7.65 | 6 | 10.89 | 8 | 4.88 | 5 |
| 2820 | 1.89 | .84 | 2.73 | 2.50 | 6.57 | 3.65 | 1.42 | 10.22 | 9 | 11.64 | 11 | 2.37 | 2 |
| 2821 | .93 | 1.80 | 2.73 | 2.50 | 3.27 | 5.41 | 2.42 | 8.68 | 9 | 11.10 | 11 | 2.34 | 2 |
| 2822 | .83 | 1.46 | 2.29 | 2.06 | 5.90 | 2.58 | 3.20 | 8.48 | 8 | 11.68 | 10 | 1.68 | 1.50 |
| 2823 | .76 | 1.00 | 1.76 | 1.03 | 4.07 | 3.72 | 2.07 | 7.79 | 8 | 9.86 | 10 | 1.54 | 2 |
| 2824 | .47 | .68 | 1.15 | .82 | 3.65 | 3.33 | 2.70 | 7.48 | 7 | 10.18 | 8 | 1.41 | 1 |
| 2825 | 2.06 | 1.14 | 3.20 | 3.30 | 5.22 | 3.15 | 2.28 | 8.37 | 8 | 10.65 | 9 | 6.87 | 7 |
| 2826 | .50 | .82 | 1.32 | 1.03 | 4.82 | 3.58 | 1.70 | 8.40 | 8 | 10.10 | 10 | 2.05 | 2 |
| 2827 | .82 | 2.00 | 2.82 | 2.50 | 4.18 | 3.29 | 2.53 | 7.47 | 6 | 10.00 | 8 | 5.25 | 5 |
| 2828 | .58 | .80 | 1.38 | 1.03 | 4.63 | 3.35 | 3.20 | 7.98 | 8 | 11.18 | 10 | 2.12 | 2 |
| 2829 | 1.70 | 1.42 | 3.12 | 3.30 | 5.58 | 3.07 | 1.65 | 8.65 | 8 | 10.30 | 9 | 6.55 | 7 |
| 2830 | .78 | 1.36 | 2.14 | 2.06 | 5.89 | 2.90 | 2.58 | 8.79 | 8 | 11.37 | 10 | 3.82 | 3 |
| 2831 | .61 | .68 | 1.29 | 1.03 | 4.99 | 3.26 | 3.41 | 8.25 | 8 | 11.66 | 10 | 2.01 | 2 |
| 2832 | 1.52 | .68 | 2.20 | 2.06 | 3.40 | 4.97 | 3.74 | 8.37 | 8 | 12.11 | 10 | 1.81 | 1.50 |
| 2833 | 1.38 | .76 | 2.14 | 2.06 | 3.51 | 5.00 | 3.37 | 8.51 | 8 | 11.88 | ..... | 1.76 | 1.50 |
| 2834 | ..... | ..... | ..... | ..... | 8.33 | 3.51 | 1.48 | 11.84 | 11 | 13.32 | ..... | 2.12 | 2 |
| 2835 | .62 | .66 | 1.28 | 1.03 | 4.63 | 3.51 | 3.02 | 8.14 | 8 | 11.16 | ..... | 2.06 | 2 |
| 2836 | 1.57 | .72 | 2.29 | 2.06 | 4.31 | 4.38 | 3.07 | 8.69 | 8 | 11.76 | ..... | 3.53 | 3 |
| 2837 | 2.08 | 1.22 | 3.30 | 3.29 | 4.48 | 2.32 | 1.99 | 6.80 | 6 | 8.79 | ..... | 10.39 | 10 |
| 2838 | .23 | .86 | 1.09 | .82 | 4.86 | 3.35 | 2.11 | 8.21 | 8 | 10.32 | ..... | 2.09 | 2 |
| 2839 | .38 | .88 | 1.26 | 1.03 | 4.75 | 3.39 | 2.99 | 8.14 | 8 | 11.13 | 10 | 2.11 | 2 |
| 2840 | .64 | 1.56 | 2.20 | 2.06 | 6.83 | 2.72 | 2.41 | 9.55 | 8 | 11.96 | 10 | 3.24 | 3 |
| 2841 | .78 | .98 | 1.76 | 1.03 | 4.55 | 3.21 | 2.67 | 7.76 | 8 | 10.43 | 10 | 1.80 | 2 |
| 2842 | 1.18 | .98 | 2.16 | 2.06 | 4.07 | 4.22 | 3.70 | 8.29 | 8 | 11.99 | 10 | 1.76 | 1.50 |
| 2843 | 2.80 | 1.20 | 4.00 | 4.10 | 5.58 | 2.44 | 1.93 | 8.02 | 7 | 9.95 | 8 | 7.36 | 7 |
| 2844 | .57 | .64 | 1.21 | .82 | 2.15 | 4.70 | 3.18 | 6.85 | 8 | 10.03 | ..... | 4.25 | 4 |
| 2845 | ..... | ..... | .... | ..... | 8.34 | 2.96 | 1.57 | 11.30 | 11 | 12.87 | ..... | 2.17 | 2 |
| 2846 | 2.10 | 1.22 | 3.32 | 3.29 | 3.84 | 3.04 | 2.58 | 6.88 | 6 | 9.46 | .... | 10.24 | 10 |
| 2847 | 1.14 | .72 | 1.86 | 2.06 | 5.98 | 1.27 | 2.88 | 7.25 | 8 | 10.13 | ..... | 3.14 | 3 |
| 2848 | .82 | 1.30 | 2.18 | 2.06 | 6.14 | 2.68 | 2.95 | 8.82 | 8 | 11.77 | ..... | 1.73 | 1.50 |
| 2849 | 1.34 | .66 | 2.00 | 2.06 | 4.55 | 4.50 | 2.64 | 9.05 | 8 | 11.69 | 10 | 3.46 | 3 |
| 2850 | 1.12 | 1.28 | 2.14 | 2.06 | 5.98 | 2.79 | 1.85 | 8.77 | 8 | 10.62 | 10 | 1.80 | 1.50 |
| 2851 | ..... | ..... | ..... | ..... | 8.77 | 3.35 | 1.20 | 12.12 | 10 | 13.32 | 12 | 2.23 | 2 |
| 2852 | .50 | .84 | 1.34 | .82 | 4.80 | 3.14 | 2.51 | 7.94 | 7 | 10.45 | 8 | 1.92 | 1 |
| 2853 | 2.02 | 1.36 | 3.38 | 3.30 | 3.91 | 3.72 | 1.62 | 7.63 | 8 | 9.25 | 9 | 7.42 | 7 |
| 2854 | .50 | .74 | 1.24 | 1.03 | 4.63 | 3.60 | 1.98 | 8.23 | 8 | 10.21 | 10 | 2.01 | 2 |

## DESCRIPTIVE LIST OF AGENTS SAMPLES, 1902.

| Station number. | Manufacturer, place of business and brand. | Sampled at |
|---|---|---|
| 2855 | Pacific Potato Special. | Portland |
| 2856 | Packer's Union Animal Corn Fertilizer | East Eddington |
| 2857 | Packer's Union Economical Vegetable Guano | Etna |
| 2858 | Packer's Union Gardiner's Complete Manure | Caribou |
| 2859 | Packer's Union Potato Manure | East Eddington |
| 2860 | Packer's Union Universal Fertilizer | East Eddington |
| 2861 | Packer's Union Wheat, Oats and Clover Fertilizer | East Eddington |
| 2862 | Quinnipiac Climax Phosphate for All Crops | Portland |
| 2863 | Quinnipiac Corn Manure | Portland |
| 2864 | Quinnipiac Mohawk Fertilizer | Portland |
| 2865 | Quinnipiac Potato Manure | Portland |
| 2866 | Quinnipiac Potato Phosphate | Portland |
| 2867 | Quinnipiac Seeding Down Manure | Portland |
| 2868 | Read's Potato Manure | Caribou |
| 2869 | Read's Practical Potato Special | Portland |
| 2870 | Read's Standard Superphosphate | Portland |
| 2871 | Read's Sure Catch Fertilizer | Portland |
| 2872 | Read's Vegetable and Vine Fertilizer | Belfast |
| 2873 | Soluble Pacific Guano | Portland |
| 2874 | Standard A. Brand | Portland |
| 2875 | Standard Bone and Potash | Belfast |
| 2876 | Standard Complete Manure | Caribou |
| 2877 | Standard Fertilizer | Portland |
| 2878 | Standard Guano for All Crops | Portland |
| 2879 | Standard Special for Potatoes | Portland |
| 2880 | Williams and Clark's Americus Amm. Bone Superphosphate | Portland |
| 2881 | Williams and Clark's Americus Corn Phosphate. | East Corinth |
| 2882 | Williams and Clark's Americus High Grade Special | Portland |
| 2883 | Williams and Clark's Americus Potato Manure | East Corinth |
| 2884 | Williams and Clark's Royal Bone Phosphate for All Crops | East Corinth |
| | THE BOWKER FERTILIZER CO., BOSTON, MASS. | |
| 2885 | Bowker's Corn Phosphate | Damascus |
| 2886 | Bowker's Early Potato Manure | Hermon |
| 2887 | Bowker's Farm and Garden Phosphate | Etna |
| 2888 | Bowker's Hill and Drill Phosphate | Damascus |
| 2889 | Bowker's Potash Bone | Bangor |
| 2890 | Bowker's Potash or Staple Phosphate | Hermon |
| 2891 | Bowker's Potato and Vegetable Fertilizer | Hermon |
| 2892 | Bowker's Potato and Vegetable Phosphate | Damascus |
| 2893 | Bowker's Six Per Cent Fertilizer | Bangor |
| 2894 | Bowker's Square Brand Bone and Potash | Houlton |
| 2895 | Bowker's Sure Crop Phosphate | Bangor |
| 2896 | Bowker's Ten Per Cent Manure | Bangor |

ANALYSES OF STATION SAMPLES, 1902.

| Station number. | Nitrogen. | | | | Phosphoric Acid. | | | | | | | Potash. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total. | | | | | Available. | | Total. | | | |
| | Soluble in water. | Insoluble in water. | Found. | Guaranteed. | Soluble. | Reverted. | Insoluble. | Found. | Guaranteed. | Found. | Guaranteed. | Found. | Guaranteed. |
| 2855 | .98 | 1.22 | 2.20 | 2.06 | 4.63 | 3.36 | 3.33 | 7.99 | 8 | 11.32 | 10 | 3.55 | 3 |
| 2856 | .98 | 1.74 | 2.72 | 2.47 | 6.78 | 2.72 | 2.45 | 9.50 | 9 | 11.95 | ..... | 2.20 | 2 |
| 2857 | .65 | .78 | 1.43 | 1.25 | 4.94 | 3.04 | 2.05 | 7.98 | 6 | 10.03 | ..... | 3.35 | 3 |
| 2858 | 1.84 | .84 | 2.68 | 2.47 | 3.14 | 3.58 | 2.00 | 6.72 | 6 | 8.72 | ..... | 10.56 | 10 |
| 2859 | .80 | 1.50 | 2.30 | 2.06 | 6.03 | 2.82 | 2.92 | 8.85 | 8 | 11.77 | ..... | 6.20 | 6 |
| 2860 | .46 | .70 | 1.16 | .82 | 6.54 | 2.36 | 2.50 | 8.90 | 8 | 11.40 | ..... | 4.01 | 4 |
| 2861 | ..... | ..... | ..... | .. .. | 6.06 | 4.16 | 1.66 | 10.22 | 11 | 11.88 | ..... | 2.24 | 2 |
| 2862 | .48 | .78 | 1.26 | 1.03 | 5.06 | 3.10 | 2.83 | 8.16 | 8 | 10.99 | 10 | 2.28 | 2 |
| 2863 | 1.38 | .76 | 2.14 | 2.06 | 3.35 | 5.23 | 3.78 | 8.58 | 8 | 12.36 | 10 | 1.81 | 1.50 |
| 2864 | .53 | .80 | 1.33 | .82 | 3.72 | 3.46 | 2.79 | 7.18 | 7 | 9.97 | 8 | 1.26 | 1 |
| 2865 | 1.35 | 1.12 | 2.47 | 2.50 | 2.86 | 3.76 | 3.62 | 6.62 | 6 | 10.24 | 8 | 5.21 | 5 |
| 2866 | 1.08 | 1.14 | 2.22 | 2.06 | 6.01 | 3.90 | 1.67 | 9.91 | 8 | 11.58 | 10 | 2.91 | 3 |
| 2867 | .26 | .88 | 1.14 | 1.03 | 5.16 | 3.79 | 1.35 | 8.97 | 8 | 10.32 | 10 | 1.90 | 2 |
| 2868 | 1.33 | 1.16 | 2.49 | 2.40 | 4.07 | 2.78 | 4.76 | 6.85 | 6 | 11.61 | 7 | 9.57 | 10 |
| 2869 | .28 | .96 | 1.24 | .82 | 2.39 | 2.64 | 2.42 | 5.03 | 4 | 7.45 | 5 | 9.33 | 8 |
| 2870 | .30 | .76 | 1.06 | .82 | 5.92 | 3.07 | 2.46 | 8.99 | 8 | 11.45 | 10 | 4.20 | 4 |
| 2871 | ..... | ..... | ..... | ..... | 5.53 | 5.52 | 1.82 | 11.05 | 10 | 12.87 | 12 | 2.31 | 2 |
| 2872 | .24 | 2.08 | 2.32 | 2.06 | 5.92 | 3.27 | 3.01 | 9.19 | 8 | 12.20 | 10 | 6.27 | 6 |
| 2873 | 1.31 | .96 | 2.27 | 2.06 | 4.55 | 3.85 | 3.74 | 8.40 | 8 | 12.14 | 10 | 1.87 | 1.50 |
| 2874 | .58 | .68 | 1.26 | .82 | 3.40 | 3.64 | 2.93 | 7.04 | 7 | 9.97 | 8 | 2.09 | 1 |
| 2875 | ..... | .... | ..... | ..... | 4.48 | 5.96 | 1.86 | 10.44 | 10 | 12.30 | 12 | 2.81 | 2 |
| 2876 | 1.66 | 1.76 | 3.42 | 3.30 | 4.27 | 2.76 | 1.82 | 7.03 | 8 | 8.85 | 9 | 7.31 | 7 |
| 2877 | 1.58 | .66 | 2.24 | 2.06 | 3.54 | 4.94 | 3.67 | 8.48 | 8 | 12.15 | 10 | 1.93 | 1.50 |
| 2878 | .60 | .80 | 1.40 | 1.03 | 4.98 | 3.40 | 3.02 | 8.38 | 8 | 11.40 | 10 | 2.26 | 2 |
| 2879 | .94 | 1.34 | 2.28 | 2.06 | 6.46 | 2.80 | 2.30 | 9.26 | 8 | 11.56 | 10 | 3.02 | 3 |
| 2880 | 1.30 | 1.34 | 2.64 | 2.50 | 6.27 | 3.62 | 2.77 | 9.89 | 9 | 12.66 | 11 | 2.10 | 2 |
| 2881 | .98 | 1.46 | 2.44 | 2.06 | 5.34 | 3.03 | 3.51 | 8.37 | 8 | ..... | 10 | 2.03 | 1.50 |
| 2882 | 1.80 | 1.40 | 3.20 | 3.30 | 5.58 | 3.22 | 1.77 | 8.80 | 8 | 10.57 | 9 | 7.31 | 7 |
| 2883 | 1.13 | 1.42 | 2.55 | 2.06 | 6.05 | 3.07 | 1.68 | 9.12 | 8 | 10.80 | 10 | 3.45 | 3 |
| 2884 | .48 | .74 | 1.22 | 1.03 | 5.02 | 3.06 | 3.20 | 8.08 | 8 | 11.28 | 10 | 2.17 | 2 |
| 2885 | 1.48 | .45 | 1.93 | 1.50 | 5.47 | 3.06 | 2.62 | 8.53 | 8 | 11.15 | 10 | 2.29 | 2 |
| 2886 | 2.72 | .56 | 3.28 | 3.00 | 5.92 | 2.78 | 1.24 | 8.70 | 7 | 9.94 | 9 | 7.38 | 7 |
| 2887 | 1.34 | .46 | 1.80 | 1.50 | 5.06 | 4.90 | 1.94 | 9.96 | 8 | 11.90 | 10 | 2.24 | 2 |
| 2888 | 1.94 | .62 | 2.56 | 2.25 | 6.06 | 3.38 | 3.80 | 9.44 | 9 | 13.24 | 11 | 2.44 | 2 |
| 2889 | .64 | .19 | .83 | .75 | 2.01 | 4.28 | 2.72 | 6.29 | 6 | 9.01 | 8 | 2.09 | 2 |
| 2890 | .68 | .15 | .83 | .75 | 3.99 | 4.13 | 2.45 | 8.12 | 8 | 10.57 | 10 | 3.13 | 3 |
| 2891 | 1.80 | .48 | 2.28 | 2.25 | 3.86 | 4.68 | 2.32 | 8.54 | 9 | 10.86 | 10 | 4.17 | 4 |
| 2892 | 1.28 | .46 | 1.74 | 1.50 | 4.78 | 3.49 | 2.88 | 8.27 | 9 | 11.15 | 11 | 2.30 | 2 |
| 2893 | .65 | .18 | .83 | .75 | 1.53 | 4.29 | 2.31 | 5.82 | 6 | 8.13 | 9 | 6.44 | 6 |
| 2894 | .89 | .66 | 1.55 | 1.50 | 1.75 | 4.67 | 6.47 | 6.42 | 6 | 12.89 | 12 | 2.16 | 2 |
| 2895 | .71 | .20 | .91 | .75 | 4.43 | 3.92 | 1.76 | 8.35 | 9 | 10.11 | 11 | 2.21 | 2 |
| 2896 | .61 | .37 | .98 | .75 | 1.88 | 3.82 | 2.13 | 5.70 | 5 | 7.83 | 7 | 9.73 | 10 |

## DESCRIPTIVE LIST OF STATION SAMPLES, 1902.

| Station number. | Manufacturer, place of business and brand. | Sampled at |
|---|---|---|
| 2897 | Gloucester Fish and Potash | Bangor |
| 2898 | Maine State Grange Chemicals | Houlton |
| 2899 | Maine State Grange Potato Manure | Houlton |
| 2900 | Stockbridge Corn and Grain Manure | Damascus |
| 2901 | Stockbridge Potato Manure | Hermon |
| 2902 | Stockbridge Seeding Down Manure | Bangor |
| | E. FRANK COE CO., NEW YORK, N. Y. | |
| 2903 | E. Frank Coe's Celebrated Special Potato Fertilizer | Winterport |
| 2904 | E. Frank Coe's Columbian Bone Superphosphate | Bangor |
| 2905 | E. Frank Coe's Columbian Corn Fertilizer | Newport |
| 2906 | E. Frank Coe's Columbian Potato Fertilizer | Winterport |
| 2907 | E. Frank Coe's Excelsior Potato Fertilizer | Belfast |
| 2908 | E. Frank Coe's Grass and Grain Special | Bangor |
| 2909 | E. Frank Coe's High Grade Ammoniated Bone Superphos | Winterport |
| 2910 | E. Frank Coe's High Grade Potato Fertilizer | Winterport |
| 2911 | E. Frank Coe's New Englander Corn Fertilizer | Etna |
| 2912 | E. Frank Coe's New Englander Potato Fertilizer | Etna |
| 2913 | E. Frank Coe's Prize Brand Grain and Grass Fertilizer | Belfast |
| 2914 | E. Frank Coe's Red Brand Excelsior Guano | Etna |
| | DEERING PACKING CO., SACO, ME. | |
| 2915 | Perfection Fertilizer | Biddeford |
| | FERNALD KEEN & TRUE CO., WEST POLAND, ME. | |
| 2916 | Sweet Corn Manure | Oxford |
| | WALTER G. FOSS, FOXCROFT, ME. | |
| 2917 | New Market Fertilizer | Foxcroft |
| 2918 | New Market Fertilizer | Foxcroft |
| | LISTER'S AGRICUL. CHEM. WORKS, NEWARK, N. J. | |
| 2919 | Lister's Animal Bone and Potash | Portland |
| 2920 | Lister's High Grade Special for Spring Crops | Portland |
| 2921 | Lister's Potato Manure | Portland |
| 2922 | Lister's Seeding Down Fertilizer | Portland |
| 2923 | Lister's Special Corn and Potato Fertilizer | Carmel |
| 2924 | Lister's Success Fertilizer | Carmel |
| | LOWELL FERTILIZER CO., BOSTON, MASS. | |
| 2925 | Swift's Lowell Animal Brand | East Corinth |
| 2926 | Swift's Lowell Bone Fertilizer | Yarmouth |
| 2927 | Swift's Lowell Dissolved Bone and Potash | Belfast |
| 2928 | Swift's Lowell Ground Bone | Yarmouth |
| 2929 | Swift's Lowell Potato Manure | Brewer |
| 2930 | Swift's Lowell Potato Phosphate | Bangor |
| | NATIONAL FERTILIZER CO., BRIDGEPORT, CONN. | |
| 2931 | Chittenden's Ammoniated Bone Phosphate | Presque Isle |
| 2932 | Chittenden's Complete Fertilizer | Ft. Fairfield |
| 2933 | Chittenden's Market Garden | Ft. Fairfield |
| | NEW ENGLAND FERTILIZER CO., BOSTON, MASS. | |
| 2934 | New England Corn Phosphate | Bangor |
| 2935 | New England Potato Fertilizer | Etna |
| 2936 | New England Seeding Fertilizer | Bangor |
| | EDWIN J. PHILBRICK, AUGUSTA, ME. | |
| 2937 | Philbrick's Fertilizer | Augusta |

## ANALYSES OF STATION SAMPLES, 1902.

| Station number. | Nitrogen. | | | | Phosphoric Acid. | | | | | | | Potash. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soluble in water. | Insoluble in water. | Total. | | Soluble. | Reverted. | Insoluble. | Available. | | Total. | | Found. | Guaranteed. |
| | | | Found. | Guaranteed. | | | | Found. | Guaranteed. | Found. | Guaranteed. | | |
| 2897 | .69 | .30 | .99 | .75 | 1.63 | 6.15 | 4.20 | 7.78 | 6 | 11.98 | 9 | 1.30 | 1 |
| 2898 | 1.92 | .62 | 2.54 | 2.50 | 6.24 | 2.43 | 3.05 | 8.67 | 8 | 11.72 | 12 | 5.08 | 4 |
| 2899 | 1.44 | .34 | 1.78 | 1.50 | 4.90 | 3.85 | 3.28 | 8.75 | 9 | 12.03 | 12 | 11.53 | 12 |
| 2900 | 2.55 | .74 | 3.29 | 3.00 | 5.25 | 2.34 | 2.14 | 7.59 | 7 | 9.73 | 9 | 7.68 | 7 |
| 2901 | 2.15 | .83 | 2.98 | 3.00 | 4.02 | 2.85 | 2.32 | 6.87 | 6 | 9.19 | 8 | 10.23 | 10 |
| 2902 | 1.99 | .76 | 2.75 | 2.25 | 2.46 | 3.63 | 2.87 | 6.09 | 6 | 8.96 | 10 | 9.53 | 10 |
| 2903 | 1.40 | .31 | 1.71 | 1.65 | 5.45 | 3.13 | 1.96 | 8.58 | 8 | 10.54 | 9.50 | 4.25 | 4 |
| 2904 | .64 | .63 | 1.27 | 1.20 | 6.84 | 2.78 | 2.68 | 9.62 | 8.50 | 12.30 | 10 | 2.44 | 2.50 |
| 2905 | .71 | .60 | 1.31 | 1.20 | 6.83 | 2.90 | 2.46 | 9.73 | 8.50 | 12.19 | 10 | 2.34 | 2.50 |
| 2906 | 1.03 | .57 | 1.60 | 1.20 | 6.70 | 2.84 | 2.45 | 9.54 | 8.50 | 11.99 | 10 | 2.69 | 2.50 |
| 2907 | 1.97 | .48 | 2.45 | 2.40 | 7.19 | 1.88 | 2.02 | 9.07 | 7 | 11.09 | 8.50 | 6.52 | 8 |
| 2908 | .28 | .67 | .95 | .80 | 6.46 | 2.75 | 2.55 | 9.21 | 8.50 | 11.76 | 10 | 1.63 | 1.50 |
| 2909 | 1.52 | .66 | 2.18 | 1.85 | 6.84 | 2.92 | 2.07 | 9.76 | 9 | 11.83 | 13 | 2.71 | 2.25 |
| 2910 | 1.25 | 1.30 | 2.55 | 2.40 | 6.32 | 2.05 | 2.17 | 8.37 | 7.50 | 10.54 | 8.50 | 5.66 | 6 |
| 2911 | .53 | .73 | 1.26 | .80 | 5.63 | 2.93 | 2.41 | 8.56 | 7.50 | 10.97 | 9 | 2.80 | 3 |
| 2912 | .34 | .66 | 1.00 | .80 | 5.97 | 2.49 | 2.50 | 8.46 | 7.50 | 10.96 | 9 | 3.01 | 3 |
| 2913 | ..... | ..... | ..... | ..... | 5.33 | 4.26 | 3.48 | 10.19 | 10.50 | 13.67 | 12 | 1.83 | 2 |
| 2914 | 2.04 | 1.10 | 3.14 | 3.40 | 7.56 | 2.09 | 2.04 | 9.65 | 9 | 11.69 | 10.50 | 5.31 | 6 |
| 2915 | ..... | .71 | .71 | .40 | 4.74 | 3.33 | .69 | 8.07 | 6 | 8.76 | 8 | 3.43 | 2 |
| 2916 | 1.36 | 1.16 | 2.52 | 2.50 | 5.98 | 3.23 | 1.91 | 9.16 | 9 | 11.07 | 11 | 2.79 | 2 |
| 2917 | .62 | .31 | .93 | .40 | 6.79 | 4.13 | .85 | 10.92 | 6 | 11.77 | 8 | 4.50 | 2 |
| 2918 | .51 | .52 | 1.03 | .40 | 3.70 | 3.66 | .87 | 7.36 | 6 | 8.23 | 8 | 3.05 | 2 |
| 2919 | ..... | ..... | ..... | ..... | 6.19 | 4.99 | 1.47 | 11 18 | 10 | 12.65 | 11 | 2.49 | 2 |
| 2920 | 1.21 | .60 | 1.81 | 1.65 | 6.76 | 2.36 | 1.21 | 9.12 | 8 | 10.33 | 9 | 10.40 | 10 |
| 2921 | 2.63 | .67 | 3.30 | 3.30 | 5.01 | 3.39 | 2.08 | 8.40 | 8 | 10.48 | 9 | 7.03 | 7 |
| 2922 | .59 | .52 | 1.11 | .83 | 5.69 | 3.01 | 1.79 | 8.70 | 7 | 10.49 | 8 | 1.69 | 1 |
| 2923 | 1.49 | .48 | 1.97 | 1.65 | 5.15 | 3.27 | 2.64 | 8.52 | 8 | 11.16 | 9 | 3.15 | 3 |
| 2924 | .94 | .42 | 1.36 | 1.24 | 7.07 | 1.81 | 2.48 | 8.88 | 9 | 11.36 | 11 | 2 24 | 2 |
| 2925 | 1.50 | 1.13 | 2.63 | 2.47 | 7.42 | 2.40 | 1.31 | 9.82 | 9 | 11.13 | 10 | 4.43 | 4 |
| 2926 | 1.31 | .68 | 1.99 | 1.65 | 4.64 | 3.14 | 1.34 | 7.78 | 8 | 9.12 | 9 | 4.03 | 3 |
| 2927 | 1.09 | .61 | 1.70 | 1.65 | 6.43 | 1.71 | 2.07 | 8.14 | 9 | 10.21 | 10 | 2.47 | 2 |
| 2928 | 1.68 | 1.16 | 2.84 | 2.47 | ..... | ..... | ..... | ..... | ..... | 24.69 | 25 | ..... | ..... |
| 2929 | .99 | .95 | 1.94 | 1.65 | 4.83 | 3.00 | 1.61 | 7.83 | 7 | 9.44 | 8 | 4.26 | 4 |
| 2930 | 1.88 | .79 | 2.67 | 2.47 | 6.16 | 2.26 | 1.63 | 8.42 | 8 | 10.05 | 9 | 6.62 | 6 |
| 2931 | .77 | .95 | 1.72 | 1.60 | 5.15 | 4.30 | 1.67 | 9.45 | 8 | 11.12 | 10 | 2.68 | 2 |
| 2932 | 2.20 | 1.22 | 3.42 | 3.30 | 6.06 | 2.16 | 1.51 | 8.22 | 8 | 9.73 | 10 | 7.31 | 6 |
| 2933 | 1.17 | 1.35 | 2.52 | 2.47 | 4.59 | 2.13 | 1.59 | 6.72 | 6 | 8.31 | 8 | 5.79 | 5 |
| 2934 | 1.70 | .55 | 2.25 | 1.65 | 3.03 | 6.38 | 1.00 | 9.41 | 8 | 10.41 | 9 | 3.16 | 3 |
| 2935 | 1.64 | .60 | 2.24 | 1.64 | 5.18 | 2.58 | 1.49 | 7.76 | 7 | 9.25 | 8 | 3.86 | 4 |
| 2936 | 1.02 | .39 | 1.41 | 1.22 | 4.93 | 2.68 | .76 | 7.61 | 7 | 8.37 | 8 | 2.07 | 2 |
| 2937 | 2.36 | .77 | 3.13 | 2.00 | 3.33 | 4.63 | 3.62 | 7.96 | 7 | 11.58 | 9 | 5.29 | 5 |

## DESCRIPTIVE LIST OF STATION SAMPLES, 1902.

| Station number. | Manufacturer, place of business and brand. | Sampled at |
|---|---|---|
| | PARMENTER & POLSEY FERT. CO., PEABODY, MASS. | |
| 2938 | A. A. Brand Fertilizer. | Presque Isle. |
| 2939 | P. & P. Potato Fertilizer | Presque Isle. |
| 2940 | Plymouth Rock Brand Fertilizer | Presque Isle. |
| 2941 | Special Potato Fertilizer | Presque Isle. |
| | PORTLAND RENDERING CO., PORTLAND, ME. | |
| 2942 | Bone Tankage | Ea. Deering |
| | PROVINCIAL CHEMICAL FERT. CO. Lt'd, St. John, N.B. | |
| 2943 | Potato Phosphate | Presque Isle. |
| | RUSSIA CEMENT CO., GLOUCESTER, MASS. | |
| 2944 | Essex A 1 Superphosphate | Bangor |
| 2945 | Essex Complete Manure for Potatoes, Roots and Vegetables. | Bangor |
| 2946 | Essex Corn Fertilizer | Bangor |
| 2947 | Essex Market Garden and Potato Manure | Bangor |
| 2948 | Essex XXX Fish and Potash | Bangor |
| | SAGADAHOC FERTILIZER CO., BOWDOINHAM, ME. | |
| 2949 | Aroostook Potato Manure | Old Town |
| 2950 | Clark's Mixture | Bowdoinham |
| 2951 | Dirigo Fertilizer | Bangor |
| 2952 | Sagadahoc High Grade Superphosphate. | Old Town |
| 2953 | Sagadahoc Special Clover Fertilizer | Bowdoinham |
| 2954 | Special Potato Fertilizer | Old Town |
| 2955 | Yankee Fertilizer | Old Town |
| | JOHN WATSON, HOULTON, ME. | |
| 2956 | Watson's Improved High Grade Potato Manure | Houlton |

ANALYSES OF STATION SAMPLES, 1901.

| Station number. | Nitrogen. | | | | Phosphoric Acid. | | | | | | | Potash. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total. | | | | | Available. | | Total. | | | |
| | Soluble in water. | Insoluble in water. | Found. | Guaranteed. | Soluble. | Reverted. | Insoluble. | Found. | Guaranteed. | Found. | Guaranteed. | Found. | Guaranteed. |
| 2938 | 4.16 | .51 | 4.67 | 4.53 | 3.96 | 4.09 | 2.40 | 8.05 | 7 | 10.45 | 8 | 8.53 | 8 |
| 2939 | 1.48 | .52 | 2.01 | 1.64 | 2.04 | 4.21 | 3.75 | 6.25 | 6 | 10.00 | 7 | 6.47 | 6 |
| 2940 | 2.04 | .52 | 2.56 | 2.47 | 3.91 | 4.08 | 3.83 | 7.99 | 8 | 11.82 | 9 | 4.46 | 4 |
| 2941 | 2.42 | .75 | 3.17 | 3.29 | 4.04 | 4.34 | 3.36 | 8.38 | 8 | 11.74 | 9 | 7.33 | 7 |
| 2942 | 3.09 | 2.37 | 5.46 | 6 | .... | .. .. | 6.53 | 9.36 | ..... | 15.89 | 14 | ..... | ..... |
| 2943 | 1.86 | .70 | 2.56 | 3 | 7.62 | 2.63 | 5.75 | 10.25 | 8 | 16.00 | 14 | 3.47 | 6.50 |
| 2944 | .53 | .56 | 1.09 | 1 | .85 | 4.19 | 5.97 | 5.04 | 7 | 11.01 | 9 | 2.54 | 2 |
| 2945 | 3.10 | .50 | 3.60 | 3.70 | 3.86 | 3.01 | 5.09 | 6.87 | 7 | 11.96 | 9 | 8.72 | 8.50 |
| 2946 | 1.88 | .52 | 2.40 | 2 | 2.47 | 4.63 | 5.61 | 7.10 | 8.50 | 12.71 | 10.50 | 3.55 | 3 |
| 2947 | 1.27 | 1.19 | 2.46 | 2 | 2.57 | 5.49 | 3.97 | 8.06 | 8 | 12.03 | 10 | 5.44 | 5 |
| 2948 | 1.18 | 1.09 | 2.27 | 2.10 | 4.21 | 3.08 | 6.25 | 7.29 | 9 | 13.54 | 12 | 2.56 | 2.25 |
| 2949 | .99 | .58 | 1.57 | 1.50 | 3.19 | 3.06 | 1.90 | 6.25 | 7 | 8.15 | 8 | 5.37 | 3 |
| 2950 | 6.46 | .82 | 7.28 | 7.50 | ..... | . ... | 2.18 | 6.75 | 2 | 8.93 | 8 | 8.63 | 8 |
| 2951 | .58 | .70 | 1.28 | 1.50 | 3.52 | 4.20 | 5.65 | 7.72 | 5 | 13.37 | 12 | 4.64 | 1.75 |
| 2952 | 1.46 | .78 | 2.24 | 2 | 4.37 | 3.96 | 1.75 | 8.33 | 7 | 10.08 | 8 | 4.63 | 3 |
| 2953 | .51 | .84 | 1.35 | 1.25 | 4.71 | 5.36 | 2.45 | 10.07 | 6 | 12.52 | 9 | 1 | ..... |
| 2954 | 1.17 | .89 | 2.06 | 2.25 | 3.38 | 3.13 | .83 | 6.51 | 8 | 7.34 | 9 | 11.06 | 7.50 |
| 2955 | 1.20 | .38 | 1.58 | .40 | 2.58 | 2.03 | 2.97 | 4.61 | 6 | 7.58 | 8 | 4.34 | 2 |
| 2956 | 1.29 | 1.74 | 3.03 | 3 | 2.47 | 3.36 | 5.49 | 5.83 | 6 | 11.32 | 7 | 5.31 | 5 |

## COMPARISON OF GUARANTEES AND STATION SAMPLES FOR THREE YEARS.

| Name of Fertilizer. | Nitrogen. | | | | Available Phosphoric Acid. | | | | Potash. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Found. | | | Guaranteed in 1902. | Found. | | | Guaranteed in 1902. | Found. | | | Guaranteed in 1902. |
| | 1900. | 1901. | 1902. | | 1900. | 1901. | 1902. | | 1900. | 1901. | 1902. | |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| Bradley's Complete Manure for Potatoes and Vegetables. | *3.06 | 3.55 | 3.51 | 3.30 | *8.70 | 8.78 | 8.52 | 8.0 | *7.41 | 7.48 | 7.90 | 7.0 |
| Bradley's Complete Manure with 10% Potash | ..... | 3.29 | 3.30 | 3.30 | . .. | 7.14 | 6.39 | 6.0 | ..... | 9.60 | 10.07 | 10.0 |
| Bradley's Corn Phosphate | *2.19 | 2.48 | 2.18 | †2.06 | *9.41 | 8.31 | 8.93 | †8.0 | *1.96 | 1 88 | 1.91 | 1.5 |
| Bradley's Eureka Fertilizer | 1.20 | 1.91 | 1.36 | 1.03 | 8.18 | 6.42 | 9.40 | 8.0 | 2.25 | 2.57 | 2.08 | 2.0 |
| Bradley's Niagara Phosphate | 1.15 | 1.55 | 1.35 | .82 | 8.31 | 8.14 | 7.15 | 7.0 | 1.35 | 1.85 | 1.23 | 1.0 |
| Bradley's Potato Fertilizer | *2.10 | 2.07 | 2.10 | 2.06 | *8.90 | 8.17 | 8.98 | †8.0 | *3.18 | 3.46 | 2.76 | †3.0 |
| Bradley's Potato Manure | 2.51 | 2.81 | 2.55 | 2.50 | 6.48 | 6.78 | 7.65 | 6.0 | 5.58 | 5.30 | 4.88 | 5.0 |
| Bradley's X. L. Superphosphate | 2.51 | 2.51 | 2.73 | 2.50 | 9.72 | 9.72 | 10.22 | 9.0 | 2.32 | 2.28 | 2.37 | 2.0 |
| Clark's Cove Bay State Fertilizer | 2.50 | 2.51 | 2.73 | †2.50 | 9.10 | 10.19 | 8.68 | 9.0 | 2.30 | 2.87 | 2.34 | 2.0 |
| Clark's Cove Bay State Fertilizer, G. G | 2.17 | 2.34 | 2.29 | †2.06 | 9.65 | 8.68 | 8.48 | †8.0 | 2.08 | 1.86 | 1.68 | †1.5 |
| Clark's Cove Bay State Fertilizer for Seeding Down | 1.13 | 1.28 | 1.76 | †1.03 | 9.10 | 11.18 | 7.79 | 8.0 | 2.47 | 1.62 | 1.54 | 2.0 |
| Clark's Cove Defiance Complete Manure | 1.29 | ..... | 1.15 | .82 | 9.08 | ..... | 7.48 | 7.0 | 1.80 | ..... | 1.41 | 1.0 |
| Clark's Cove Great Planet Manure, A. A | ..... | 3.02 | 3.20 | 3.30 | .... | 8.69 | 8.37 | 8.0 | ..... | 7.29 | 6.87 | 7.0 |
| Clark's Cove King Philip Alkaline Guano | 1.20 | 1.35 | 1.32 | 1.03 | 8.49 | 8.25 | 8.40 | †8.0 | 2.16 | 2.56 | 2.05 | †2.0 |
| Clark's Cove Potato Manure | ..... | ..... | 2.82 | 2.50 | . ... | .... | 7.47 | 6.0 | ..... | . .... | 5.25 | 5.0 |
| Cleveland Fertilizer for All Crops | 1.15 | ..... | 1.38 | 1.03 | 9.37 | ... . | 7.98 | 8.0 | 2.29 | ..... | 2.12 | 2.0 |
| Cleveland High Grade Complete Manure | ... | 3.32 | 3.12 | 3.30 | ..... | 9.29 | 8.65 | 8.0 | ..... | 7.18 | 6.55 | 7.0 |
| Cleveland Potato Phosphate | 2.24 | 2.03 | 2.14 | 2.06 | 8.52 | 9.03 | 8.79 | 8.0 | 3.29 | 3.08 | 3.82 | 3.0 |
| Cleveland Seeding Down Fertilizer | 1.23 | 1.30 | 1.29 | 1.03 | 8.65 | 8.92 | 8.25 | 8.0 | 2.39 | 2.00 | 2.01 | 2.0 |
| Cleveland Superphosphate | 2.07 | 2.16 | 2.20 | 2.06 | 8.68 | 9.02 | 8.37 | †8.0 | 1.87 | 1.73 | 1.81 | †1.5 |
| Crocker's Corn Phosphate | 2.15 | 2.06 | 2.14 | †2.06 | 9.05 | 8.13 | 8.51 | †8.0 | 2.00 | 1.94 | 1.76 | †1.5 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crocker's Grass and Oats Fertilizer | ..... | ..... | ..... | ..... | 10.29 | 11.13 | 11.84 | †11.0 | 2.11 | 2.18 | 2.12 | 2.0 |
| Crocker's New Rival Ammoniated Superphosphate | 1.03 | 1.91 | 1.28 | †1.03 | 9.64 | 8.18 | 8.14 | †8.0 | 2.06 | 2.79 | 2.08 | †2.0 |
| Crocker's Potato, Hop and Tobacco Fertilizer | *1.90 | 2.06 | 2.29 | †2.06 | *9.01 | 8.02 | 8.69 | †8.0 | *3.34 | 3.08 | 3.53 | †3 0 |
| Crocker's Special Potato Manure | ..... | ..... | 3.30 | 3.29 | ..... | .. .. | 6.80 | 6.0 | ..... | ..... | 10.39 | 10.0 |
| Crocker's Superior Phosphate | 1.00 | ..... | 1.09 | .82 | 7.75 | ..... | 8.21 | 8.0 | 1.82 | ..... | 2.09 | 2.0 |
| Cumberland Guano | ... .. | ..... | 1.26 | 1.03 | ..... | .... | 8.14 | 8.0 | .... | ..... | 2.11 | 2.0 |
| Cumberland Potato Fertilizer | *2.08 | 2.07 | 2.20 | 2.06 | *8.98 | 8.93 | 9.55 | †8.0 | *3.16 | 2.82 | 3.24 | 3.0 |
| Cumberland Seeding Down Manure | 1.24 | 1.34 | 1.76 | 1.03 | 8.69 | 8.84 | 7.76 | 8.0 | 2.27 | 2.34 | 1.80 | 2.0 |
| Cumberland Superphosphate | 2.14 | 2.06 | 2.16 | 2.06 | 9.05 | 8.79 | 8.29 | 8.0 | 2.32 | 1.98 | 1.76 | †1.5 |
| Darling's Blood, Bone and Potash | 3.78 | 4.15 | 4.00 | 4.10 | 8.17 | 8.15 | 8.02 | 7.0 | 7.24 | 7.96 | 7.36 | †7.0 |
| Great Eastern General Fertilizer | 1.02 | 1.36 | 1.21 | .82 | 8.91 | 8.90 | 6.85 | 8.0 | 3.71 | 4.14 | 4.25 | 4.0 |
| Great Eastern Grass and Oats Fertilizer | ..... | ... .. | ..... | ..... | 10.17 | 11.05 | 11.30 | 11.0 | 1.97 | 2 03 | 2.17 | 2.0 |
| Great Eastern High Grade Special Potato Manure | 3.25 | 3.67 | 3.32 | 3.29 | 6.98 | 6.71 | 6.88 | 6.0 | 9.58 | 10.04 | 10.24 | 10.0 |
| Great Eastern Potato Manure | *1.97 | 2.09 | 1.86 | †2.06 | *8.85 | 8.74 | 7.25 | 8.0 | *3.26 | 3.51 | 3.14 | †3.0 |
| Great Eastern Northern Corn Special | 2.12 | 2.08 | 2 18 | 2.06 | 9.04 | 9.45 | 8.82 | 8.0 | 1.51 | 2.18 | 1.73 | †1.5 |
| Otis Potato Fertilizer | 2.06 | 2.00 | 2.00 | †2.06 | 8.54 | 9.08 | 9.05 | †8.0 | 3.16 | 3.45 | 3.46 | 3.0 |
| Otis Superphosphate | 2.12 | 2.09 | 2.14 | †2.06 | 8.36 | 8.76 | 8.77 | †8.0 | 1.75 | 2.03 | 1.80 | †1.5 |
| Pacific Dissolved Bone and Potash | ..... | ..... | ..... | ..... | ..... | ..... | 12.1? | 10.0 | ..... | ..... | 2.23 | 2.0 |
| Pacific Grass and Grain Fertilizer | 1.24 | 1.18 | 1.34 | .82 | 8.49 | 7.50 | 7.94 | 7.0 | 1.36 | 1.93 | 1.92 | †1.0 |
| Pacific High Grade General Fertilizer | .... | 2.97 | 3.38 | 3.30 | .... | 9.09 | 7.63 | 8.0 | ..... | 7.19 | 7.42 | 7.0 |
| Pacific Nobsque Guano | 1.23 | 1.64 | 1.24 | †1.03 | 8.43 | 9.41 | 8.23 | 8.0 | 2.22 | 2.55 | 2.01 | 2.0 |
| Pacific Potato Special | 2.08 | 2.17 | 2.20 | 2.06 | 9.00 | 9.22 | 7.99 | 8.0 | 2.97 | 3.04 | 3.55 | 3.0 |
| Packer's Union Animal Corn Fertilizer | 2.62 | 2.72 | 2.72 | 2.47 | 10.03 | 8.94 | 9.50 | †9.0 | 2.36 | 2.37 | 2.20 | 2.0 |
| Packer's Union Economical Vegetable Guano | 1.21 | 1.80 | 1.43 | 1.25 | 8.78 | 6.56 | 7.98 | 6.0 | 3.25 | 3.27 | 3.35 | 3.0 |
| Packer's Union Gardeners' Complete Manure | ..... | 2.31 | 2.68 | 2.47 | ..... | 6.60 | 6.72 | 6.0 | ..... | 10.87 | 10.58 | 10.0 |
| Packer's Union Potato Manure | 2.30 | 2.08 | 2.30 | 2.06 | 9.16 | 8.08 | 8.85 | 8.0 | 6.13 | 7.95 | 6.20 | 6.0 |
| Packer's Union Universal Fertilizer | *1.20 | 1.32 | 1.16 | .82 | *8.62 | 8.18 | 8.90 | 8.0 | *3 82 | 4.17 | 4.01 | †4.0 |
| Packer's Union Wheat, Oats and Clover Fertilizer | ..... | ..... | ..... | ..... | 10 80 | 10.49 | 10.22 | 11.0 | 2.14 | 1.99 | 2.24 | 2.0 |
| Quinnipiac Climax Phosphate | 1.47 | | 1.26 | 1.03 | 9.25 | ..... | 8.16 | 8.0 | 2.58 | .. | 2.28 | 2.0 |
| Quinnipiac Corn Manure | 2.12 | 2.44 | 2.14 | 2.06 | 9.66 | 7 84 | 8.58 | †8.0 | 1.75 | 1.90 | 1.87 | 1.5 |
| Quinnipiac Mohawk Fertilizer | ..... | 1.68 | 1.33 | .82 | ..... | 7.52 | 7.18 | 7.0 | ..... | 1.37 | 1.26 | 1.0 |
| Quinnipiac Potato Manure | 2.49 | 2.51 | 2.47 | †2.50 | 8.30 | 5.72 | 6.62 | 6.0 | 5.50 | 5.79 | 5.21 | 5.0 |
| Quinnipiac Potato Phosphate | 2.18 | 2.30 | 2.22 | 2.06 | 10.24 | 8.18 | 9.91 | 8.0 | 3.20 | 3.48 | 2.91 | 3.0 |

* Average of two analyses.

† Guarantee changed in 1901.

COMPARISON OF GUARANTEES AND STATION SAMPLES FOR THREE YEARS—Continued.

| Name of Fertilizer. | Nitrogen. | | | | Available Phosphoric Acid. | | | | Potash. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Found. | | | Guaranteed in 1902. | Found. | | | Guaranteed in 1902. | Found. | | | Guaranteed in 1902. |
| | 1900. | 1901. | 1902. | | 1900. | 1901. | 1902. | | 1900. | 1901. | 1902. | |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| Quinnipiac Seeding Down Manure | 1.26 | 1.49 | 1.14 | †1.03 | 7.97 | 9.11 | 8.97 | †8.0 | 1.97 | 2.51 | 1.90 | 2.0 |
| Read's Potato Manure | 2.36 | 2.23 | 2.49 | 2.40 | 7.35 | 6.60 | 6.85 | †6.0 | 10.60 | 10.59 | 9.57 | 10.0 |
| Read's Practical Potato Special | 1.08 | 1.32 | 1.24 | .82 | 6.11 | 4.66 | 5.03 | 4.0 | 8.29 | 9.22 | 9.33 | 8.0 |
| Read's Standard Fertilizer | 1.09 | ..... | 1.06 | .82 | 8.58 | ..... | 8.99 | 8.0 | 4.23 | ..... | 4.20 | 4.0 |
| Read's Sure Catch | ..... | ..... | ..... | ..... | 6.61 | ..... | 11.05 | †10.0 | 4.18 | ..... | 2.31 | †2.0 |
| Read's Vegetable and Vine Fertilizer | 2.08 | 2.15 | 2.32 | †2.06 | 8.61 | 7.99 | 9.19 | †8.0 | 5.85 | 6.92 | 6.27 | †6.0 |
| Soluble Pacific Guano | ..... | ..... | 2.27 | 2.06 | ..... | ..... | 8.40 | 8.0 | ..... | ..... | 1.87 | 1.5 |
| Standard A Brand | 1.28 | 1.03 | 1.26 | .82 | 7.97 | 7.56 | 7.04 | 7.0 | 1.58 | 1.46 | 2.09 | 1.0 |
| Standard Bone and Potash | ..... | ..... | ..... | ..... | ..... | ..... | 10.44 | †10.0 | ..... | ..... | 2.81 | †2.0 |
| Standard Complete Manure | 3.34 | ..... | 3.42 | 3.30 | 8.30 | ..... | 7.03 | 8.0 | 7.15 | ..... | 7.31 | 7.0 |
| Standard Fertilizer | 2.32 | 2.27 | 2.24 | †2.06 | 8.88 | 8.07 | 8.48 | 8.0 | 2.69 | 1.85 | 1.93 | †1.5 |
| Standard Guano | 1.23 | 1.47 | 1.40 | †1.03 | 8.41 | 9.50 | 8.38 | †8.0 | 2.33 | 2.51 | 2.26 | †2.0 |
| Standard Special for Potatoes | 2.20 | ..... | 2.28 | 2.06 | 9.48 | ..... | 9.26 | 8.0 | 3.14 | ..... | 3.02 | 3.0 |
| Williams & Clark's Americus Ammoniated Bone Superphosphate | 2.58 | 2.42 | 2.64 | †2.50 | 9.67 | 9.76 | 9.89 | 9.0 | 2.49 | 2.52 | 2.10 | 2.0 |
| Williams & Clark's Americus Corn Phosphate | 2.20 | 2.40 | 2.44 | 2.06 | 9.44 | 9.35 | 8.37 | †8.0 | 1.94 | 1.95 | 2.08 | 1.5 |
| Williams & Clark's Americus High Grade Special | ..... | ..... | 3.20 | 3.30 | ..... | ..... | 8.80 | 8.0 | ..... | ..... | 7.31 | 7.0 |
| Williams & Clark's Americus Potato Manure | 2.10 | *2.17 | 2.55 | 2.06 | 8.78 | *8.54 | 9.12 | ..... | 3.42 | *3.29 | 3.45 | 3.0 |
| Williams & Clark's Royal Bone Phosphate | 1.10 | 1.42 | 1.22 | 1.03 | 9.42 | 10.48 | 8.08 | †8.0 | 2.63 | 2.16 | 2.17 | 2.0 |
| Bowker's Corn Phosphate | 1.63 | 1.56 | 1 93 | †1.50 | 8.32 | 9.37 | 8.53 | †8.0 | 2.49 | 2.31 | 2.29 | 2.0 |
| Bowker's Early Potato Manure | 3.19 | *2.80 | 3.28 | 3.0 | 7.80 | *7.79 | 8.70 | 7.0 | 7.58 | *7.36 | 7.38 | 7.0 |
| Bowker's Farm and Garden Phosphate | 1.66 | 1.47 | 1.80 | 1.50 | 9.74 | 8.71 | 9.96 | †8.0 | 2.26 | 2.54 | 2.24 | 2.0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bowker's Hill and Drill Phosphate | 2.26 | 2.19 | 2.56 | 2.25 | 8.90 | 9.41 | 9.44 | 9.0 | 2.30 | 2.23 | 2.44 | 2.0 |
| Bowker's Potash Bone | .81 | .99 | .83 | .75 | 7.72 | 9.65 | 6.29 | 6.0 | 2.57 | 1.22 | 2.09 | 2.0 |
| Bowker's Potash or Staple Phosphate | .84 | .88 | .83 | .75 | 8.82 | 7.94 | 8.12 | 8.0 | 3.28 | 5.38 | 3.13 | 3.0 |
| Bowker's Potato and Vegetable Fertilizer | 2.51 | 2.10 | 2.28 | 2.25 | 9.62 | 10.17 | 8.54 | †9.0 | 4.58 | 4.60 | 4.17 | 4.0 |
| Bowker's Potato and Vegetable Phosphate | 1.66 | 1.53 | 1.74 | 1.50 | 10 48 | 8.98 | 8.27 | †9.0 | 2.34 | 2.06 | 2.30 | 2.0 |
| Bowker's 6% Potato Fertilizer | .92 | .90 | .83 | .75 | 9.06 | 8.31 | 5.82 | †6.0 | 6.18 | 6.59 | 6.44 | 6.0 |
| Bowker's Square Brand Bone and Potash | 1.85 | 1.53 | 1.55 | 1.50 | 6.65 | 6.75 | 6.42 | 6.0 | 2.51 | 2.28 | 2.16 | 2.0 |
| Bowker's Sure Crop Phosphate | .96 | .90 | .91 | .75 | 9.69 | 8.90 | 8 35 | †9.0 | 2.05 | 1.96 | 2.21 | †2.0 |
| Bowker's 10% Manure | .82 | .75 | .98 | .75 | 6.98 | 7.55 | 5.70 | †5.0 | 10.44 | 9.67 | 9.73 | 10.0 |
| Gloucester Fish and Potash | .84 | .83 | .99 | .75 | 10.29 | 6.20 | 7.78 | 6.0 | 1.35 | 2.20 | 1.30 | 1.0 |
| Maine State Grange Chemicals | 2.84 | 2.55 | 2.54 | 2.50 | 9.35 | 9.31 | 8.67 | 8.0 | 5.44 | 4.45 | 5.08 | 4.0 |
| Maine State Grange Potato Manure | 1.68 | 1.68 | 1.78 | 1.50 | 10.96 | 10.08 | 8.75 | 9.0 | 11.16 | 12.69 | 11.53 | 12.0 |
| Stockbridge Corn and Grain Manure | 3.02 | 2.83 | 3.29 | 3.00 | 9.88 | 7.82 | 7.59 | †7.0 | 7.07 | 7.1- | 7.68 | †7.0 |
| Stockbridge Potato and Vegetable Manure | *3.09 | 2.87 | 2.98 | †3.00 | *7.51 | 7.40 | 6.87 | 6.0 | *10.08 | 10.50 | 10.23 | 10.0 |
| Stockbridge Seeding Down Manure | 2.05 | 2.27 | 2.75 | †2.25 | 8.01 | 7.72 | 6.09 | 6.0 | 10.22 | 10.04 | 9.53 | 10.0 |
| E. Frank Coe's Celebrated Special Potato Fertilizer | ..... | 1.82 | 1.71 | 1.65 | .... | 8.77 | 8.58 | 8.0 | ..... | 4.07 | 4.25 | 4.0 |
| E. Frank Coe's Columbian Bone Superphosphate | ..... | ..... | 1.27 | 1.20 | ..... | ..... | 9.62 | 8.5 | ..... | ..... | 2 44 | 2.5 |
| E. Frank Coe's Columbian Corn Fertilizer | 1.19 | 1.42 | 1.31 | †1.20 | 9.06 | 9.52 | 9.73 | 8.5 | 2.55 | 2.39 | 2.34 | 2.5 |
| E. Frank Coe's Columbian Potato Fertilizer | 1.42 | 1.26 | 1.60 | 1.20 | 9.24 | 8.76 | 9.54 | 8.5 | 2.81 | 2.43 | 2.39 | 2.5 |
| E. Frank Coe's Excelsior Potato Fertilizer | *2.81 | 2.46 | 2.45 | †2.40 | *7.72 | 8.12 | 9.07 | †7.0 | *7.57 | 8.61 | 6.52 | 8.0 |
| E. Frank Coe's Famous Grass and Grain Special | 1.08 | 1.02 | .95 | .80 | 9.96 | 8.59 | 9.21 | 8.5 | 2.08 | 1.87 | 1.90 | †1.5 |
| E. Frank Coe's High Grade Ammoniated Bone Superphosphate | 1.97 | 1.71 | 2.18 | 1.85 | 8.68 | 9.49 | 9.76 | 9.0 | 2.72 | 2.51 | 2.71 | 2.25 |
| E. Frank Coe's High Grade Potato Fertilizer | 2.46 | 2.31 | 2.55 | 2.40 | 7.99 | 8.37 | 8.37 | †7.5 | 6.70 | 6.07 | 5 16 | †6.0 |
| E. Frank Coe's New Englander Corn Fertilizer | .96 | 1.20 | 1.26 | .80 | 8.44 | 8.44 | 8.56 | 7.5 | 3.18 | 3.20 | 2 80 | 3.0 |
| E. Frank Coe's New Englander Potato Fertilizer | 1.03 | 1.21 | 1.00 | .80 | 9.07 | 8.34 | 8.46 | †7.5 | 3.61 | 3.26 | 3.01 | 3.0 |
| E. Frank Coe's Prize Brand Grain and Grass Fertilizer | ..... | .... | ..... | .... | 10.36 | 9.99 | 10.19 | 10.5 | 2.26 | 2.06 | 1.83 | 2.0 |
| E. Frank Coe's Red Brand Excelsior Guano | 3.43 | 3.06 | 3.14 | 3.40 | 8.56 | 9.03 | 9.65 | 9.0 | 6.31 | 7.24 | 5.71 | 6.0 |
| Perfection Fertilizer | ..... | ..... | .71 | .40 | ..... | .... | 8.07 | 6.0 | ..... | ..... | 3.43 | 2.0 |
| Sweet Corn Manure | ..... | ..... | 2.52 | 2.50 | ..... | ..... | 9.16 | 9.0 | ..... | ..... | 2.79 | 2.0 |
| New Market Fertilizer | ..... | ..... | .97 | .40 | ..... | ..... | 9.14 | 6.0 | ... | .... | 3.78 | 2.0 |
| Lister's Animal Bone and Potash No. 2 | ..... | ..... | ..... | ..... | ..... | 9.73 | 11.18 | 10.0 | ..... | 2.53 | 2.49 | 2.0 |
| Lister's High Grade Special for Spring Crops | 1.88 | 1.59 | 1.81 | 1.65 | 8.46 | 8.74 | 9.12 | 8.0 | 10.02 | 10.83 | 10.40 | 10.0 |
| Lister's Potato Manure | ..... | ..... | 3.30 | 3.30 | ..... | ..... | 8.40 | 8.0 | ..... | ..... | 7.03 | 7.0 |

* Average of two analyses. † Guarantee changed in 1901.

COMPARISON OF GUARANTEES AND STATION SAMPLES FOR THREE YEARS—Concluded.

| Name of Fertilizer. | Nitrogen. | | | | Available Phosphoric Acid. | | | | Potash. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Found. | | | Guaranteed in 1902. | Found. | | | Guaranteed in 1902. | Found. | | | Guaranteed in 1902. |
| | 1900. | 1901. | 1902. | | 1900 | 1901. | 1902. | | 1900. | 1901. | 1902. | |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| Lister's Seeding Down Fertilizer | .81 | 1.10 | 1.11 | †.83 | 12.14 | 7.70 | 8.70 | †7.0 | 1.05 | 1.92 | 1.69 | †1.0 |
| Lister's Special Corn and Potato Fertilizer | *1.77 | 1.65 | 1.97 | 1.65 | *8.95 | 8.50 | 8.52 | 8.0 | *2.98 | 3.33 | 3.15 | 3.0 |
| Lister's Success Fertilizer | 1.44 | 1.26 | 1.36 | 1.24 | 9.89 | 9.62 | 8.88 | †9.0 | 8.10 | 2.39 | 2.24 | 2.0 |
| Swift's Lowell Animal Brand | 2.64 | 2.86 | 2.63 | 2.47 | 9.64 | 8.18 | 9.82 | 9.0 | 4.13 | 3.98 | 4.43 | 4.0 |
| Swift's Lowell Bone Fertilizer | 1.75 | 1.98 | 1.99 | 1.65 | 8.07 | 7.29 | 7.78 | 8.0 | 3.35 | 3.17 | 4.03 | 3.0 |
| Swift's Lowell Dissolved Bone and Potash | 1.88 | 1.87 | 1.70 | 1.65 | 9.41 | 9.68 | 8.14 | 9.0 | 2.39 | 2.20 | 2.47 | 2.0 |
| Swift's Lowell Ground Bone | 2.04 | 1.72 | 2.84 | 2.47 | .... | 15.18 | 24.69 | 25.0 | ..... | .... | ..... | ..... |
| Swift's Lowell Potato Manure | 1.84 | 1.95 | 1.94 | 1.65 | 6.99 | 7.61 | 7.83 | 7.0 | 4.01 | 4.56 | 4.26 | 4.0 |
| Swift's Lowell Potato Phosphate | 2.54 | 2.81 | 2.67 | 2.47 | 8.27 | 7.90 | 8 42 | 8.0 | 7.03 | 6.48 | 6.62 | 6.0 |
| Chittenden's Ammoniated Bone Phosphate | 2.12 | 1.88 | 1.72 | †1.60 | 9.81 | 10.17 | 9.45 | †8.0 | 2.25 | 2.84 | 2 68 | 2.0 |
| Chittenden's Complete Fertilizer | 3.35 | 3.47 | 3.42 | †3.30 | 7.72 | 8.13 | 8.22 | 8.0 | 6.14 | 6.79 | 7.31 | 6.0 |
| Chittenden's Market Garden Fertilizer | 2.57 | *2.55 | 2.52 | †2.47 | 6.38 | 7.78 | 6.72 | †6.0 | 5.68 | 5.81 | 5.79 | 5.0 |
| New England Corn Phosphate | 1.70 | 1.91 | 2.25 | 1.64 | 8.79 | 8.10 | 9.41 | 8.0 | 3.31 | 3.61 | 3.16 | 3.0 |
| New England Potato Fertilizer | *1.82 | 1.77 | 2.24 | 1.64 | *7.10 | 8.09 | 7.76 | 7.0 | *4.24 | 4.52 | 3.86 | 4.0 |
| New England Seeding Fertilizer | ..... | ..... | 1.41 | 1.22 | ..... | ..... | 7.61 | 7.0 | ..... | ..... | 2.07 | 2.0 |
| A. A. Brand Fertilizer | ..... | 4.54 | 4 67 | 4.53 | ..... | 8.92 | 8.05 | 7.0 | ... .. | 8.84 | 8.53 | 8.0 |
| P. and P. Potato Fertilizer | 1.97 | 1.75 | 2.01 | 1.64 | 7.94 | 6.36 | 6.25 | 6.0 | 5.66 | 6.50 | 6.47 | †6.0 |
| Plymouth Rock Brand Fertilizer | 2.90 | 2.71 | 2.56 | 2.47 | 9.30 | 8.53 | 7.99 | 8.0 | 5.11 | 5.00 | 4.46 | 4.0 |
| Special Potato Fertilizer | 3.49 | 3.36 | 3.17 | 3.29 | 9.65 | 8.47 | 8.38 | 8.0 | 7.47 | 7.55 | 7.33 | 7.0 |
| E. J. Philbrick's High Grade Fertilizer | 1.63 | 1.87 | 3.13 | 2.00 | 7.62 | 7.43 | 7.90 | 7.0 | 6.34 | 4.90 | 5.29 | 5.0 |
| Portland Rendering Co.'s Bone Tankage | 4.84 | 4.57 | 5.46 | †6.00 | 9.64 | 9.32 | 15.89 | 14.0 | .... | ..... | .... | ..... |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Provincial Chemical Co.'s Special Potato Phosphate | 3.21 | 3.31 | 2.56 | †3.00 | 9.67 | 8.44 | 10.25 | †8.0 | 4.76 | 3.41 | 3.47 | †6.5 |
| Essex A 1 Superphosphate | ..... | 1.14 | 1.09 | 1.00 | ..... | 6.33 | 5.04 | 7.0 | ..... | 2.02 | 2.54 | 2.0 |
| Essex Complete Manure for Potatoes, Roots and Vegetables | 3.96 | 4.20 | 3.60 | 3.70 | 8.15 | 8.81 | 6.87 | 7.0 | 8.69 | 9.15 | 8.72 | 8.5 |
| Essex Corn Fertilizer | 2.13 | 2.08 | 2.40 | 2.00 | 8.77 | 8.33 | 7.10 | 8.5 | 3.41 | 3.05 | 3.55 | 3.0 |
| Essex Market Garden and Potato Manure | 2.03 | 2.39 | 2.46 | 2.00 | 8.96 | 8.10 | 8.06 | †8.0 | 6.27 | 6.09 | 5.44 | 5.0 |
| Essex XXX Fish and Potash | 2.76 | 2.47 | 2.27 | 2.10 | 9.56 | 8.13 | 7.29 | 9.0 | 2.82 | 2.76 | 2.56 | 2.25 |
| Aroostook Potato Manure | .. .. | 1.36 | 1.57 | 1.50 | ..... | 7.31 | 6.25 | 7.0 | ..... | 4.01 | 5.37 | 3.0 |
| Clark's Mixture | ..... | ..... | 7 28 | 7.50 | ..... | ..... | 6.75 | ..... | ..... | ..... | 8.63 | 8.0 |
| Dirigo Fertilizer | 1.58 | 1.19 | 1.28 | †1.50 | 6.12 | 7.76 | 7.72 | †5.0 | 4.23 | 2.78 | 4.64 | †1.75 |
| Sagadahoc Special Potato Fertilizer | *1.44 | 2.14 | 2.06 | †2.50 | *9.32 | 5.87 | 6.51 | †6.0 | 9.69 | 10.93 | 11.06 | 7.5 |
| Sagadahoc Superphosphate | *1.86 | 2.09 | 2.24 | †2.00 | 8.78 | 8.37 | 8.33 | †7.0 | *4.41 | 3.86 | 4.63 | †3.0 |
| Yankee Fertilizer | 1.02 | 1.15 | 1.58 | †.40 | 5.20 | 5.28 | 4.61 | †6.0 | 4.90 | ..... | 4.34 | 2.0 |
| Watson's Improved High Grade Potato Manure | 2.72 | 3.17 | 3.03 | †3.00 | 5.84 | 6.36 | 5.83 | 6.0 | 4.97 | 6.02 | 5.31 | 5.0 |

* Average of two analyses.

† Guarantee changed in 1901.

## COMPARISON OF GUARANTEES AND STATION SAMPLES FOR THREE YEARS.

It is important for the purchaser of fertilizers to know how the goods have compared with the guarantee, not merely for one year but for several years. Formerly we have printed a table comparing the analysis of the manufacturers' and Station samples for the year with the guarantee. In the table on pages 170 to 175 there is given a comparison of the analyses of the samples collected by the Station for the years 1900, 1901 and 1902 with the guarantee of the manufacturers. When the guarantee has been changed in 1900 from that of the previous years the fact is indicated by a †, and where more than one analysis of the same brand was made in 1900, this is indicated by a *.

One of the claims which fertilizer manufacturers are making for the superiority of their goods over "home mixed fertilizers" is that the former are "manufactured." This should mean, if it means anything, that the goods are more evenly mixed and therefore more uniform. In some instances in which two or more samples of the same brand have been taken and analyzed, they have been found to differ from each other quite materially. The samples were taken with a great deal of care by experienced men from a large number of packages. It would not seem difficult to make "home mixed fertilizers" which should run as uniform as some of the brands here reported upon.

In studying the table of comparison of guarantees of the Station samples for three years, it will be found that many goods run quite uniform year after year. This is particularly true as regards phosphoric acid and is readily understood when it is remembered that the "superphosphate" is the starting point and that the materials furnishing the nitrogen and potash are added to this. The potash and nitrogen are the more expensive substances in fertilizers and greater variations in composition are found in these constituents.

# VARIATION IN TRILLIUM GRANDIFLORUM.

H. W. BRITCHER.

To all those who have cultivated vegetable or flower gardens it has probably been a matter of frequent observation that, in any bed composed of plants all of the same sort, there have been individual differences or variations. Some of the plants have been more vigorous growers than others and have come to earlier maturity. In some of the plants the flowers have been uniformly of larger size or perhaps have shown a tendency to be double or in some other way differ from the flowers of the rest of the plants. The horticulturist, growing plants in large quantities, has a much wider field of observation. When he finds a plant exhibiting a slight variation which he considers of value he carefully saves the seed and from it raises another generation of plants, some of which will show the variation in intensified form. From such plants another generation is raised and the process is repeated until the variation becomes fixed, that is, until the desired character is present in all the plants raised from the selected seed. This is known as artificial selection and is one of the ways in which new and improved varieties are produced. Propagation from sports, or plants in which variations become fixed in a single generation, is another method and hybridization is still another. By these methods most of our cultivated crops of the present day have been developed or artificially evolved from, in most cases, pactically worthless ancestors. In his book entitled "The Evolution of Our Native Fruits," Professor Bailey says: "The American grapes have given rise to eight hundred domestic varieties, the American plums to more than two hundred, the raspberries to three hundred and various other native fruits have a long cultivated progeny."

In "Animals and Plants Under Domestication" Darwin presented a vast amount of material on artificial selection, and in

his "Origin of Species" he showed how by natural selection, the slight variations normally occurring in nature would be magnified until, in the course of ages, several distinct species would result from a single ancestor and differ from that ancestor even more than they differ among themselves. Several instances showing how extensive may be the variations in a single wild species have been given by Wallace in his book entitled "Darwinism." Such differences among individuals of a species in a state of nature are much commoner than the indifferent observer would believe, but are well known to those who, in studying carefully small groups of either plants or animals, have been brought in contact with large numbers of individuals of the same species. Within recent years the results of several such studies of variations have appeared in the scientific periodicals and the main purpose of this article is to present in tabular form the size and color variations found in a number of individuals of the common white trillium or large-flowered wake-robin.

The tendency of *Trillium grandiflorum* to exhibit variations of the sort known as phyllody, or the reversion of flower parts to leaves, is well known to botanists. Professor Charles A. Davis read a paper on the subject at the meeting of the American Association for the Advancement of Science in 1897 and exhibited a large number of specimens collected in Michigan. Mrs. L. L. Goodrich, a well-known botanist of Syracuse, has studied the same phenomenon at considerable length and has found that the variations persist even after removal of the plants to a suitable place in the garden. The results of part of her work were very briefly and unostentatiously noted a few years ago in "Meehan's Monthly." The occurrence of the same phenomenon in other localities has occasionally been brought to the notice of some scientific society so that the present account can lay no claim to novelty. However, it is thought worth while to record in permanent form the actual measurements of various parts of a series of plants exhibiting different degrees of this sort of variation, which, as soon as it materially affects the essential organs of the plant, namely the stamens and pistils, prevents the formation of seed by the plant. This of course stops the direct propagation of the more abnormal forms by the method of seed selection. It is conceivable, however, that such forms

may be increased by natural division of the rootstocks of the two-stemmed individuals, and perhaps also by cross pollination, as in many of the very abnormal forms one or more of the stamens produce pollen, which is probably potent. In fact among the plants examined, in only five flowers was it noted that none of the stamens were pollen bearing.

The plants here described were collected near Syracuse, N. Y., in a wood of second-growth timber. The soil, which overlies a limestone formation and which is more or less intermixed with limestone rocks, is a rich leaf-mould on top and a compact clay loam beneath. The rootstocks usually rest on the clay and most of the roots penetrate into it. The richness of the locality in trillium individuals is only poorly shown by the first illustration. In a strip of territory hardly a quarter of a mile wide and less than a mile long normal plants occur by the hundreds of thousands and abnormal ones by thousands. At some spots barely half a dozen abnormal forms can be found among a thousand plants, while at a nearby spot from ten to fifteen out of every hundred will show coloration of the petals with the accompanying variations of the other parts. On the whole, probably at least one per cent of the plants shows abnormal variation.

While the measurements given indicate approximately the size of each part, they do not of course indicate the shape of the outline. This varies to some extent in the cases of the leaf blades and sepals, but very conspicuously so in the case of the petals. Thus, as the photographs and table of measurements show, plants 13 and 143 have petals more than three times as long as they are wide, while numbers 22 and 31 are nearly as broad as they are long. Numbers 84, 105 and 163*a* are just as broad as long, while 163*b* is broader than long. But, however much the outline may vary, the petal never loses its pointed tip. In some of the specimens examined it was in a deeper notch than shown in plants 111 and 22. It comes more nearly being obliterated in extremely broad-petaled plants of the normal sort, such as number 12, than its does in any of the greatly abnormal varieties.

In the following table all the measurements are in millimeters, the greatest width of the organ being given first and then the length. When two figures are given in the column "Length of ovary," the first refers to the length of the stalk or stem upon

which in such specimens the ovary is placed, and the second refers to the length of the ovary proper, as indicated usually by a slight swelling.

In the column "Color of petal" the size of the green centre stripe is frequently given and also its position (proximally or distally) when it is not approximately in the centre of the petal. When the green stripe is rather narrow it usually does not extend to either the base or the tip of the petal.

ABBREVIATIONS.

*b.* border, referring to a space from two to four millimeters wide along the margin of the petal. *c.* centre. *dis.* distally, referring to the distal part of the petal. *ed.* edge, referring to a space not more than one millimeter wide along the margin of the petal. *gr.* green. *lt.* light. *m.* margin, referring to a space from four to six millimeters wide along the margin of the petal. *pr.* proximally, referring to the proximal or basal part of the petal. *wh.* white.

NOTES.

1-14. Typical plants, showing ordinary slight variations of the different parts.

15-17. Plants with petioled leaves, all the other parts being typical.

18-129. Abnormal plants, showing variation in petal coloration and in structure of parts.

22. Length of petioles 76, 81 and 86 mm.

24. The green centre stripes on the petals are 10, 14 and 18 mm. wide.

25. The green centre stripes on the petals are 12, 14 and 22 mm. wide.

26. The third petal is smaller than the others, the stem being 14 mm. long and the blade 18x30 mm. in size; two stamens are aborted, the others having filaments 14, 10, 8 and 4 mm. long and anthers 9, 9, 5 and 0 mm. long.

27. Two stamens are aborted.

28. Two leaves are reduced to spurs 2 mm. long.

29. All the leaves are aborted.

30. One petal is entirely white, one has a trace of green along its centre distally and the other has a green stripe 3 mm. wide along the centre.

31. All the leaves are reduced to spurs 1 mm. long at the tip of the rootstock.

32. All the leaves are reduced to spurs 3 mm. long and one petal has a white border distally.

36. Two petals are entirely white.

37. One petal is entirely white.

49. One petal has a green centre 22x26 mm. in size.

55. One petal has a green centre 2x16 mm. in size.

65. Four stamens have filaments only 2 mm. long and anthers aborted.

67. Five stamens have filaments only 3 mm. long and anthers aborted.

71. All the leaves are reduced to spurs 4 mm. long.

73. One petal is entirely white, one has a green centre 1 x 15 mm. in size and the other has a green centre 2 x 30 mm. in size.

74. One petal is entirely white, one has a green centre 1 x 12 mm. in size and the third has a green centre 2 x 14 mm. in size.

92. One leaf is reduced to a spur 1 mm. long. There are only two sepals, which are opposite and two petals, also opposite. One stamen is 11 mm. long and 4 mm. wide and is white edged.

104. Three stamens have filaments only 2 mm. long and anthers aborted.

106. One petal is reduced to a spur 3 mm. long.

108. Four stamens are aborted.

109. Two stamens have filaments 6 mm. long and anthers aborted. The ovary is stalked.

111. Two leaves are reduced to spurs.

120. Five stamens have filaments 10 mm. long and anthers aborted.

121. One stamen is aborted.

122. One leaf has the petiole 135 mm. long and the blade 40 x 60 mm. in size. The stamens of the outer whorl have filaments 14, 28 and 4 mm. long and anthers 6, 8 and 0 mm. long, while those of the inner whorl have filaments 30, 28 and 24 mm. long and anthers 8, 8 and 7 mm. long.

123. One leaf is reduced to a spur 4 mm. long.

124. The stamens of the outer whorl have filaments 6, 12 and 18 mm. long and anthers 6, 8 and 8 mm. long, while those of the inner whorl have filaments 9, 13 and 21 mm. long and anthers 8, 8 and 10 mm. long.

127. Two leaves entirely aborted. There are only two sepals which are opposite and two petals, also opposite: two stamens aborted.

128. The place of the ovary is taken by three leaf-like parts with stems 10 mm. long and blades 5 x 14 mm. in size. Within this circle are two pollen bearing stamens with filaments 4 and 7 mm. long and anthers 5 and 10 mm. long.

129. In this plant the sepals are marked with white, one being two-thirds white, one being one-half white and one having a white edge along one side proximally.

130-133. Typical plants in which a single rootstock gives rise to two stems.

134-180. Abnormal plants in which a single rootstock gives rise to two stems.

141 *a*. One petal has a stem 6 mm. long and a blade 16 x 30 mm. in size.

143 *b*. One petal is entirely white.

144 *b*. Two petals are green at their bases and white distally.

146 *a*. All the leaves are reduced to spurs 3 mm. long.

*b*. All parts above the leaves are aborted.

147 *a*. Two leaves are reduced to spurs.

*b*. One leaf is reduced to a spur and all parts above leaves are aborted.

148 *a*. One stamen is aborted and two of the others have filaments 13 and 6 mm. long and anthers 8 and 8 mm. long. Pistil aborted.

*b*. One stamen has the filament 12 mm. long and the anther 9 mm. long. Pistil aborted. Leaves in both *a* and *b* are reduced to spurs 1 mm. long.

149 *a*. All the leaves are reduced to spurs.

*b*. Only one leaf present, the other two being mere spurs.

151 *a*. This flower has twelve stamens each with a filament 7 mm. long and an anther 8 mm. long.

152 *a*. The sepals are red and green and the place of the petals is taken by three stamens having red filaments 6 mm. long and green anthers 6 mm. long.

*b*. The sepals are red-veined and interpolated between the sepals and petals are six extra stamens, green in color and having filaments 5 mm. long and anthers 8 mm. long.

164 *a*. Five stamens have light green filaments only 2 mm. long and anthers aborted.

165 *b*. Four stamens aborted.

166 *a*. Two stamens aborted.

175 *a*. Only two leaves are present, the blades of which are 43 x 52 mm. and 35 x 56 mm. in size. There are only two sepals which are opposite and two petals, also opposite.

176 *b*. Three stamens with filaments 6 mm. long and anthers aborted.

177 *b*. Two leaves reduced to spurs and three stamens with filaments 2 mm. long and anthers aborted.

178 *a*. Only three stamens, which are green in color and have filaments 29, 20 and 9 mm. long and anthers 10, 10 and 0 mm. long.

181. A typical plant in which the rootstock sends up three stems.

182-185. Abnormal plants in which the rootstock sends up three stems.

184 *a*. Five stamens have filaments 3 mm. long and anthers aborted.

*b*. The third leaf has the petiole 38 mm. long and the blade 34 x 44 mm. in size.

*c*. The place of the third leaf is taken by two leaves having a common petiole 4 mm. long and separate petioles 50 and 46 mm. long and blades 23 x 38 mm. and 26 x 44 mm. in size.

185 *a*. One petal has a green stripe 5 mm. wide along one margin.

*b*. One petal has four yellowish green veins, one is notched at one side and the notch has a yellow pollen bearing edge backed by a green line, and the third petal is lacking, its space being left open.

*c*. Only two sepals, the space of the third being open. Only two petals which are opposite. One of them is 37 x 44 mm. in size and entirely white. The other is 48 x 54 mm. in size and has directly over the open sepal space a green stripe 26 x 54 mm. in size. Within this green stripe is a white stripe 3 x 54 mm. in size. Two of the stamens have their filaments fused and their anthers fused for 4 mm., the remaining 10 mm. of the anthers being separate.

| Number. | Length of stem. | Length of petiole. | Size of leaf blade. | Length of peduncle. | Length of sepal stem. | Size of sepal blade. | Length of petal stem. | Size of petal blade. |
|---|---|---|---|---|---|---|---|---|
| 1 | 180 | ..... | 80×90 | 63 | ..... | 18×46 | ..... | 33×50 |
| 2 | 210 | ..... | 67×95 | 44 | ..... | 13×33 | ..... | 26×47 |
| 3 | 225 | ..... | 80×95 | 70 | ..... | 18×54 | ..... | 46×80 |
| 4 | 235 | ..... | 65×100 | 50 | ..... | 10×38 | ..... | 20×54 |
| 5 | 275 | ..... | 95×115 | 73 | ..... | 18×48 | ..... | 34×58 |
| 6 | 290 | ..... | 78×115 | 62 | ..... | 16×48 | ..... | 28×72 |
| 7 | 305 | ..... | 94×118 | 64 | ..... | 16×47 | ..... | 30×64 |
| 8 | 325 | ..... | 85×120 | 64 | ..... | 15×58 | ..... | 30×62 |
| 9 | 340 | ..... | 113×157 | 93 | ..... | 20×56 | ..... | 37×74 |
| 10 | 220 | ..... | 84×84 | 60 | ..... | 20×38 | ..... | 36×50 |
| 11 | 240 | ..... | 100×124 | 84 | ..... | 26×58 | ..... | 40×74 |
| 12 | 230 | ..... | 86×100 | 53 | ..... | 14×36 | ..... | 30×49 |
| 13 | 250 | ..... | 67×98 | 47 | ..... | 10×36 | ..... | 18×50 |
| 14 | 265 | ..... | 105×113 | 60 | ..... | 21×50 | ..... | 40×68 |
| 15 | 130 | 22 | 54×90 | 80 | ..... | 17×49 | ..... | 25×60 |
| 16 | 145 | 6 | 46×76 | 50 | ..... | 14×40 | ..... | 19×54 |
| 17 | 295 | 2 | 68×105 | 50 | ..... | 12×44 | ..... | 17×56 |
| 18 | 130 | 50 | 90×96 | 75 | ..... | 33×70 | 14 | 48×60 |
| 19 | 162 | 2 | 42×56 | 30 | ..... | 11×26 | ..... | 22×34 |
| 20 | 115 | 20 | 50×60 | 28 | 4 | 20×44 | 12 | 22×42 |
| 21 | 115 | 4 | 36×50 | 12 | ..... | 13×34 | 4 | 24×34 |
| 22 | 65 | 81 | 35×54 | 118 | ..... | 20×40 | 8 | 30×34 |
| 23 | 175 | 18 | 42×62 | 54 | ..... | 17×40 | 7 | 26×44 |
| 24 | 335 | ..... | 110×140 | 72 | ..... | 25×58 | ..... | 46×68 |
| 25 | 210 | 22 | 90×98 | 90 | ..... | 24×48 | ..... | 46×60 |
| 26 | 35 | 90 | 46×60 | 85 | 14 | 26×45 | 22 | 25×40 |
| 27 | 57 | 12 | 46×52 | 18 | ..... | 18×34 | 6 | 19×32 |
| 28 | 18 | 60 | 32×45 | 95 | ..... | 20×37 | 3 | 22×37 |
| 29 | 2 | ..... | spurs | 155 | ..... | 30×63 | 22 | 32×54 |
| 30 | 165 | 5 | 74×79 | 62 | ..... | 24×42 | ..... | 32×52 |
| 31 | ..... | ..... | spurs | 168 | ..... | 28×60 | 12 | 45×50 |
| 32 | 60 | ..... | spurs | 106 | ..... | 30×57 | 8 | 32×50 |
| 33 | 230 | 10 | 96×98 | 70 | ..... | 30×60 | ..... | 46×62 |
| 34 | 195 | 10 | 68×96 | 56 | ..... | 18×48 | ..... | 30×55 |
| 35 | 235 | 40 | 86×115 | 112 | ..... | 20×56 | ..... | 26×70 |
| 36 | 250 | 3 | 44×82 | 38 | ..... | 12×40 | ..... | 16×58 |
| 37 | 190 | 6 | 45×86 | 54 | ..... | 13×38 | ..... | 17×47 |
| 38 | 235 | 5 | 56×82 | 38 | ..... | 16×42 | ..... | 20×60 |
| 39 | 200 | 12 | 56×72 | 62 | ..... | 20×42 | ..... | 33×58 |
| 40 | 155 | 35 | 60×84 | 65 | 4 | 24×54 | 15 | 24×52 |
| 41 | 160 | 12 | 56×80 | 50 | ..... | 17×50 | ..... | 30×55 |
| 42 | 120 | 46 | 43×58 | 80 | ..... | 20×50 | ..... | 26×50 |
| 43 | 140 | 38 | 45×70 | 82 | ..... | 22×42 | ..... | 31×48 |
| 44 | 195 | 6 | 48×82 | 50 | ..... | 16×48 | ..... | 20×60 |
| 45 | 180 | 38 | 76×86 | 70 | ..... | 20×48 | 6 | 30×46 |
| 46 | 180 | 10 | 56×90 | 43 | ..... | 18×48 | ..... | 26×56 |
| 47 | 130 | 40 | 49×68 | 52 | 4 | 28×46 | 22 | 35×42 |
| 48 | 210 | 8 | 70×78 | 18 | ..... | 18×44 | 6 | 38×44 |
| 49 | 255 | 4 | 62×74 | 34 | ..... | 15×40 | ..... | 37×46 |
| 50 | 10 | 70 | 68×85 | 122 | ..... | 24×55 | ..... | 30×55 |
| 51 | 55 | 135 | 52×78 | 210 | ..... | 24×54 | ..... | 33×57 |
| 52 | 210 | 4 | 60×58 | 26 | ..... | 15×42 | ..... | 27×38 |
| 53 | 110 | 56 | 34×60 | 102 | ..... | 16×42 | ..... | 38×44 |
| 54 | 185 | 12 | 58×86 | 45 | ..... | 20×52 | 10 | 28×42 |
| 55 | 235 | 2 | 62×72 | 48 | ..... | 15×34 | ..... | 25×45 |
| 56 | 260 | ..... | 93×117 | 56 | ..... | 17×43 | ..... | 38×55 |
| 57 | 270 | ..... | 87×105 | 43 | ..... | 20×49 | ..... | 37×66 |
| 58 | 190 | 4 | 55×76 | 26 | ..... | 16×42 | 4 | 24×40 |
| 59 | 165 | 6 | 68×68 | 32 | ..... | 24×44 | 6 | 38×40 |
| 60 | 54 | 36 | 36×50 | 64 | ..... | 20×42 | 8 | 22×38 |
| 61 | 58 | 6 | 33×48 | 10 | ..... | 12×28 | 6 | 15×18 |
| 62 | 80 | 4 | 47×68 | 3 | ..... | 15×34 | 4 | 15×28 |
| 63 | 30 | 12 | 52×54 | 2 | ..... | 14×37 | 12 | 15×20 |
| 64 | 16 | 42 | 22×30 | 44 | 4 | 15×26 | 8 | 15×24 |
| 65 | 75 | 34 | 42×50 | 66 | ..... | 18×34 | 4 | 16×30 |

| Color of petal. | Length of filament. | Color of filament. | Length of anther. | Color of anther. | Length of ovary. | Color of ovary. | Length of style. | Color of style. | |
|---|---|---|---|---|---|---|---|---|---|
| white | 8 | white | 12 | white | 8 | white | 10 | white | note. |
| white | 6 | white | 10 | white | 5 | white | 5 | white | |
| white | 10 | white | 12 | white | 10 | white | 10 | white | |
| white | 8 | white | 7 | white | 5 | white | 5 | white | |
| white | 8 | white | 10 | white | 8 | white | 8 | white | |
| white | 9 | white | 9 | white | 8 | white | 10 | white | |
| white | 8 | white | 10 | white | 8 | white | 8 | white | |
| white | 9 | white | 10 | white | 6 | white | 6 | white | |
| white | 10 | white | 10 | white | 9 | white | 6 | white | |
| white | 6 | lt. gr. | 12 | white | 8 | white | 8 | white | |
| white | 8 | lt. gr. | 14 | white | 10 | white | 10 | white | |
| white | 7 | lt. gr. | 8 | lt. gr. | 7 | white | 4 | white | |
| white | 7 | lt. gr. | 8 | lt. gr. | 4 | white | 6 | white | |
| white | 8 | lt. gr. | 14 | lt. gr. | 10 | white | 10 | white | |
| white | 8 | lt. gr. | 12 | lt. gr. | 6 | lt. gr. | 9 | lt. gr. | note. |
| white | 8 | white | 8 | white | 5 | white | 5 | white | note. |
| white | 8 | white | 8 | lt. gr. | 6 | white | 6 | white | note. |
| gr. c., m. wh | 14 | lt. gr. | 14 | lt. gr. | 18 | green | 22 | green | |
| gr. c., m. wh | 5 | lt. gr. | 8 | lt. gr. | 4 | green | 5 | green | |
| gr., ed. wh. dis | 9 | lt. gr. | 10 | lt. gr. | 8 | green | 10 | green | |
| green | 7 | lt. gr. | 10 | green | 12 | green | 12 | green | |
| gr., m. wh. dis | 10 | lt. gr. | 12 | lt. gr. | 7 | lt. gr. | 10 | lt. gr. | note. |
| gr. pr., wh. dis | 11 | lt. gr. | 9 | lt. gr. | 8 | green | 8 | lt. gr. | |
| gr. c. 10, 14, 18 wide | 10 | lt. gr. | 15 | lt. gr. | 10 | lt. gr. | 20 | white | |
| gr. c. 12, 14, 22 | 11 | lt. gr. | 11 | lt. gr. | 7 | lt. gr. | 14 | white | note. |
| note | note | green | note | green | | | | | note. |
| gr., ed. wh. dis | 5 | lt. gr. | 12 | lt. gr. | 6 | green | 9 | green | note. |
| gr., m. wh. dis | 8 | lt. gr. | 8 | lt. gr. | 5 | green | 7 | green | note. |
| gr., m. wh. dis | 14 | lt. gr. | 10 | lt. gr. | 8 | green | 20 | green | note. |
| gr. c. 5×36 | 8 | white | 9 | white | 5 | white | 9 | white | note. |
| gr. m. wh | 12 | lt. gr. | 10 | lt. gr. | 12 | green | 24 | green | note. |
| gr., m. wh. dis | 10 | lt. gr. | 10 | lt. gr. | 10 | green | 12 | green | note. |
| gr. c. 8×45 | 10 | lt. gr. | 10 | lt. gr. | 9 | lt. gr. | 18 | lt. gr. | |
| gr. c. 16×54 | 10 | white | 11 | white | 8 | lt. gr. | 14 | lt. gr. | |
| gr. c. 2×18 dis | 11 | white | 12 | lt. gr. | 6 | lt. gr. | 14 | white | |
| gr. c. 1×20. | 10 | white | 8 | lt. gr. | 4 | white | 6 | white | note. |
| gr. c. 2×30 | 7 | white | 5 | lt. gr. | 4 | lt. gr. | 5 | white | note. |
| gr. c. 16×42 | 10 | lt. gr. | 10 | lt. gr. | 6 | green | 14 | lt. gr. | |
| gr. c. 4×32 | 8 | white | 10 | lt. gr. | 5 | lt. gr. | 13 | white | |
| gr., b. wh. dis | 11 | lt. gr. | 10 | lt. gr. | 10 | green | 12 | lt. gr. | |
| gr. c. 12×35 | 10 | white | 10 | lt. gr. | 8 | lt. gr. | 12 | white | |
| gr. c. 5×32 | 7 | lt. gr. | 9 | green | 5 | lt. gr. | 10 | lt. gr. | |
| gr. c. 5×32 | 8 | lt. gr. | 10 | lt. gr. | 4 | lt. gr. | 10 | white | |
| gr. c. 4×35 | 10 | lt. gr. | 9 | lt. gr. | 6 | lt. gr. | 9 | white | |
| gr., b. wh. dis | 12 | green | 12 | lt. gr. | 5 | green | 11 | lt. gr. | |
| gr. c. 4×35 | 10 | white | 9 | lt. gr. | 6 | white | 7 | white | |
| gr., m. wh | 14 | green | 9 | green | 16 | green | 14 | green | |
| gr. c. 26×34 | 7 | green | 9 | green | 8 | green | 12 | green | |
| gr. c. pr. 14×18 | 11 | lt. gr. | 7 | lt. gr. | 4 | green | 6 | lt. gr. | note. |
| gr. c. 3×24 | 10 | lt gr. | 10 | green | 8 | green | 12 | lt. gr. | |
| gr. c. 10×50 | 10 | lt. gr. | 10 | green | 7 | green | 11 | lt. gr. | |
| gr., b. wh. | 2 | green | | | 5 | green | 9 | green | |
| gr. c. 14×42 | 8 | lt. gr. | 8 | green | 4 | green | 11 | lt. gr. | |
| gr., ed. wh | 9 | lt. gr. | 7 | green | 7 | green | 7 | lt. gr. | |
| gr. c. 16×24 | 10 | lt. gr. | 10 | green | 5 | green | 9 | lt. gr. | note. |
| gr. c. 28×38 | 8 | lt. gr. | 10 | lt. gr. | 5 | lt. gr. | 11 | lt. gr. | |
| gr. c. dis. 2×13 | 10 | lt. gr. | 12 | lt. gr. | 6 | lt. gr. | 12 | white | |
| green | 9 | lt. gr. | 7 | green | 7 | green | 12 | green | |
| green | 11 | lt. gr. | 14 | green | 10 | green | 14 | green | |
| gr., b. wh. dis | 10 | lt. gr. | 6 | green | 8 | green | 10 | green | |
| gr., ed. wh. dis | 2 | green | | | 4 | green | 4 | green | |
| gr., b. wh. dis | 2 | green | | | 3 | green | 4 | green | |
| gr., ed. wh. dis | 1 | lt. gr. | | | 5 | green | 8 | green | |
| gr., ed. wh. dis | 2 | lt. gr. | | | 4 | green | 6 | green | |
| gr., ed. wh. dis | 5 | lt. gr. | 7 | green | 6 | green | 4 | green | note. |

| Number. | Length of stem. | Length of petiole. | Size of leaf blade. | Length of peduncle. | Length of sepal stem. | Size of sepal blade. | Length of petal stem. | Size of petal blade. |
|---|---|---|---|---|---|---|---|---|
| 66 | 170 | 6 | 9×98 | 46 | ..... | 22×54 | 8 | 44×50 |
| 67 | 170 | 8 | 65×74 | 40 | ..... | 19×46 | 4 | 32×42 |
| 68 | 130 | 10 | 62×64 | 40 | ..... | 22×46 | 8 | 29×38 |
| 69 | 140 | 6 | 68×70 | 24 | ..... | 19×47 | 8 | 34×44 |
| 70 | 140 | 6 | 54×68 | 6 | ..... | 17×38 | 4 | 32×38 |
| 71 | 60 | ..... | spurs | 112 | ..... | 24×54 | 6 | 32×46 |
| 72 | 165 | 2 | 54×85 | 40 | ..... | 14×42 | 4 | 22×40 |
| 73 | 210 | 22 | 54×70 | 78 | ..... | 20×50 | ..... | 26×60 |
| 74 | 185 | 8 | 57×75 | 65 | ..... | 20×46 | ..... | 28×50 |
| 75 | 280 | ..... | 100×108 | 53 | ..... | 22×46 | ..... | 42×56 |
| 76 | 250 | 2 | 95×115 | 56 | ..... | 24×54 | ..... | 45×60 |
| 77 | 210 | 2 | 102×128 | 34 | ..... | 20×58 | 2 | 44×55 |
| 78 | 180 | 4 | 95×92 | 45 | ..... | 22×48 | ..... | 50×52 |
| 79 | 235 | 8 | 56×80 | 60 | ..... | 16×42 | ..... | 29×50 |
| 80 | 185 | 8 | 54×75 | 40 | ..... | 15×44 | 10 | 22×40 |
| 81 | 200 | 8 | 76×80 | 48 | ..... | 20×52 | 4 | 40×44 |
| 82 | 225 | 2 | 56×62 | 13 | ..... | 17×36 | 4 | 25×30 |
| 83 | 280 | 10 | 85×108 | 54 | ..... | 22×72 | ..... | 46×80 |
| 84 | 100 | 2 | 54×40 | 17 | ..... | 16×27 | ..... | 25×25 |
| 85 | 180 | 2 | 65×95 | 44 | ..... | 18×50 | ..... | 28×49 |
| 86 | 180 | 5 | 60×90 | 44 | ..... | 16×50 | 4 | 26×46 |
| 87 | 140 | 36 | 52×76 | 42 | 2 | 18×46 | 14 | 18×39 |
| 88 | 60 | 42 | 37×58 | 58 | ..... | 15×38 | 12 | 15×36 |
| 89 | 175 | 2 | 54×78 | 36 | ..... | 16×44 | ..... | 29×38 |
| 90 | 120 | 32 | 52×68 | 78 | ..... | 17×38 | ..... | 20×42 |
| 91 | 90 | 125 | 85×110 | 192 | ..... | 44×78 | 8 | 42×70 |
| 92 | 1 | 140 | 64×70 | 182 | ..... | 28×44 | 4 | 20×36 |
| 93 | 165 | 16 | 64×66 | 10 | 2 | 22×46 | 16 | 31×40 |
| 94 | 70 | 100 | 66×74 | 152 | ..... | 28×50 | 4 | 31×50 |
| 95 | 2 | ..... | spurs | 115 | 12 | 28×44 | 22 | 21×35 |
| 96 | 5 | ..... | spurs | 170 | ..... | 28×56 | 10 | 32×50 |
| 97 | 90 | 34 | 35×56 | 52 | 2 | 18×44 | 20 | 28×42 |
| 98 | 65 | 36 | 50×66 | 54 | 6 | 19×44 | 20 | 22×37 |
| 99 | 75 | 60 | 52×70 | 67 | 22 | 22×48 | 34 | 31×45 |
| 100 | 110 | 30 | 48×62 | 46 | 6 | 20×49 | 17 | 27×40 |
| 101 | 190 | 6 | 74×78 | 25 | ..... | 11×50 | 6 | 31×41 |
| 102 | 195 | 6 | 75×100 | 29 | ..... | 20×56 | 4 | 34×50 |
| 103 | 5 | ..... | spurs | 140 | 24 | 32×67 | 48 | 40×56 |
| 104 | 120 | 36 | 42×58 | 38 | 4 | 22×42 | 16 | 25×37 |
| 105 | 100 | 8 | 44×50 | 6 | 4 | 18×40 | 14 | 30×30 |
| 106 | 125 | 48 | 54×68 | 27 | 23 | 30×55 | 45 | 26×44 |
| 107 | 80 | 8 | 30×48 | 6 | 2 | 12×32 | 10 | 16×28 |
| 108 | 175 | 5 | 65×66 | 42 | ..... | 26×46 | 3 | 36×46 |
| 109 | 25 | 110 | 40×58 | 88 | 21 | 27×50 | 35 | 23×40 |
| 110 | 70 | 60 | 56×70 | 82 | 10 | 26×52 | 34 | 33×60 |
| 111 | ..... | 130 | 83×90 | 150 | 8 | 35×64 | 38 | 41×54 |
| 112 | 8 | 60 | 36×52 | 90 | 6 | 25×44 | 14 | 20×40 |
| 113 | 95 | 64 | 55×76 | 74 | 8 | 25×56 | 26 | 22×46 |
| 114 | 155 | 50 | 74×94 | 36 | 14 | 28×64 | 37 | 40×52 |
| 115 | 125 | 80 | 66×80 | 112 | 4 | 27×52 | 12 | 36×52 |
| 116 | 130 | 44 | 68×66 | 64 | 6 | 26×50 | 26 | 36×46 |
| 117 | 105 | 46 | 67×80 | 72 | 5 | 26×55 | 24 | 38×55 |
| 118 | 100 | 30 | 48×60 | 45 | 4 | 19×40 | 20 | 28×40 |
| 119 | 45 | 73 | 52×68 | 94 | ..... | 25×48 | 12 | 34×45 |
| 120 | 225 | 44 | 58×78 | 44 | 10 | 27×50 | 28 | 22×44 |
| 121 | 65 | 83 | 59×69 | 33 | 44 | 33×59 | 64 | 36×52 |
| 122 | 14 | 117 | 47×60 | 94 | 36 | 27×52 | 46 | 28×45 |
| 123 | 8 | 110 | 28×50 | 140 | 2 | 18×40 | 8 | 12×32 |
| 124 | 8 | 100 | 60×76 | 100 | 18 | 20×55 | 42 | 33×50 |
| 125 | 60 | 75 | 52×58 | 66 | 8 | 26×36 | 25 | 23×40 |
| 126 | 70 | 58 | 40×58 | 87 | 2 | 18×40 | 8 | 14×30 |
| 127 | 235 | ..... | 110×135 | 75 | ..... | 22×52 | ..... | 45×68 |

| Color of petal. | Length of filament. | Color of filament. | Length of anther. | Color of anther. | Length of ovary. | Color of ovary. | Length of style. | Color of style. | |
|---|---|---|---|---|---|---|---|---|---|
| gr., b. wh. | 12 | lt. gr. | 12 | green | 8 | lt. gr. | 16 | green | |
| gr., ed. wh | 8 | lt. gr. | 10 | green | 7 | lt. gr. | 17 | green | note. |
| gr., ed. wh. | 7 | green | 9 | green | 9 | green | 12 | green | |
| gr., b. wh. | 14 | green | 10 | green | 7 | green | 15 | green | |
| gr. c. pr. 26×28 | 4 | green | 6 | green | 7 | green | 6 | lt. gr. | |
| gr. c. 20×40 | 10 | lt. gr. | 8 | lt. gr. | 8 | green | 14 | green | note. |
| gr., ed. wh. | 8 | green | 11 | green | 7 | green | 12 | green | |
| note. | 12 | white | 9 | lt. gr. | 6 | green | 12 | white | note. |
| note. | 9 | white | 8 | lt. gr. | 4 | white | 6 | white | note. |
| gr. c. 30×40 | 10 | white | 12 | lt. gr. | 6 | lt. gr. | 16 | white | |
| gr. c. 36×52 | 12 | lt. gr. | 14 | lt. gr. | 12 | lt. gr. | 18 | lt. gr. | |
| gr., ed. wh. | 8 | lt. gr. | 12 | green | 6 | lt. gr. | 16 | green | |
| gr. c. 30×50 | 10 | lt. gr. | 14 | lt. gr. | 10 | green | 20 | green | |
| gr. c. 4×30 | 10 | white | 10 | lt. gr. | 6 | lt. gr. | 10 | white | |
| gr., ed. wh. dis. | 8 | lt. gr. | 10 | green | 6 | green | 14 | green | |
| gr. c. pr. 30×28 | 5 | lt. gr. | ..... | ..... | 6 | lt. gr. | 10 | green | |
| gr., ed. wh. dis. | 1 | lt. gr. | ..... | ..... | 4 | lt. gr. | 4 | lt. gr. | |
| gr. c. pr. 22×45 | 14 | lt. gr. | 16 | lt. gr. | 14 | green | 20 | green | |
| gr., ed. wh. dis. | 2 | lt. gr. | ..... | ..... | 3 | lt. gr. | 5 | lt. gr. | |
| gr., ed. wh. | 8 | lt. gr. | 11 | green | 5 | lt. gr. | 16 | green | |
| gr., ed. wh. | 10 | lt. gr. | 10 | green | 8 | lt. gr. | 14 | green | |
| gr., ed. wh. dis | 1 | lt. gr. | ..... | ..... | 10 | lt. gr. | 8 | green | |
| gr., ed. wh. | 11 | green | 8 | green | 8 | green | 8 | green | |
| gr., ed. wh. | 7 | green | 15 | green | 6 | lt. gr. | 12 | green | |
| gr. c. 2×10 | 7 | white | 7 | lt. gr. | 4 | green | 5 | lt. gr. | |
| gr., m. wh | 10 | white | 10 | lt. gr. | 12 | lt. gr. | 18 | lt. gr. | |
| gr. c. 8×34 | 8 | white | 7 | lt. gr. | 3 | lt. gr. | 3 | lt. gr. | note. |
| gr. b. wh. dis. | 1 | green | ..... | ..... | 7 | green | 15 | green | |
| gr. c. 15×36 | 10 | lt. gr. | 8 | green | 10 | green | 12 | lt. gr. | |
| gr., b. wh. dis | 6 | green | ..... | ..... | 5 | green | 5 | green | |
| gr., ed. wh | 12 | lt. gr. | 10 | green | 9 | green | 17 | green | |
| gr., b. wh. dis | 10 | green | 10 | green | 8 | green | 12 | green | |
| gr., b. wh. dis | 14 | lt. gr. | 8 | green | 12 | green | 10 | green | |
| gr., b. wh. | 18 | lt. gr. | 10 | green | 14 | green | 14 | green | |
| gr., ed. wh. dis. | 10 | lt. gr. | 11 | green | 12 | green | 12 | green | |
| green | 4 | green | ..... | ..... | 5 | green | 10 | green | |
| green | 14 | green | 10 | green | 9 | green | 13 | green | |
| gr., ed. wh. dis | 16 | lt. gr. | 12 | green | 30 | green | 16 | green | |
| green | 9 | green | 7 | green | 8 | green | 8 | green | note. |
| green | 2 | green | ..... | ..... | 8 | green | 14 | green | |
| green | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | note. |
| gr., b. wh. dis | 2 | green | ..... | ..... | 3 | green | 6 | green | |
| gr., b. wh. | 8 | green | 10 | green | 8 | green | 14 | green | note. |
| green | 12 | lt. gr. | 8 | green | 15-5 | green | 18 | green | note. |
| gr., m. wh. dis | 18 | lt. gr. | 8 | lt. gr. | 12-6 | green | 16 | green | |
| gr., b. wh. dis | 18 | green | 14 | green | 14-6 | green | 24 | green | note. |
| gr., b. wh. dis | 10 | lt. gr. | 8 | green | 5-6 | lt. gr. | 12 | green | |
| gr., ed. wh. dis. | 14 | green | 10 | green | 14-6 | green | 22 | green | |
| gr., ed. wh. dis. | 14 | lt. gr. | 13 | green | 16-10 | green | 22 | green | |
| gr., b. wh. dis | 12 | lt. gr. | 14 | green | 7-13 | green | 13 | lt. gr. | |
| gr., b. wh. dis | 18 | green | 11 | green | 10-8 | green | 22 | green | |
| gr., b. wh. dis | 15 | lt. gr. | 12 | green | 7-6 | green | 16 | lt. gr. | |
| gr., m. wh. dis | 16 | green | 8 | green | 9-5 | green | 12 | green | |
| gr., b. wh. dis | 11 | lt. gr. | 9 | green | 10-5 | green | 15 | green | |
| green | 14 | lt. gr. | 8 | lt. gr. | 10-6 | green | 16 | green | note. |
| gr., b. wh. dis | 34 | green | 10 | green | 23-10 | green | 27 | green | note. |
| gr. pr., wh. dis. | ..... | note | ..... | ..... | 15-5 | green | 13 | green | note. |
| gr., ed. wh. dis. | 10 | green | 6 | green | 4-4 | green | 7 | green | note. |
| gr., ed. wh. dis. | ..... | note | ..... | ..... | 16-8 | green | 20 | green | note. |
| green | 3 | green | ..... | ..... | 8-8 | green | 16 | green | |
| green | 3 | green | 5 | lt. gr. | 5-5 | green | 6 | green | |
| gr. c. 2×68 | 6 | lt. gr. | 10 | lt. gr. | 10 | white | 8 | white | note. |

| Number. | Length of stem. | Length of petiole. | Size of leaf blade. | Length of peduncle. | Length of sepal stem. | Size of sepal blade. | Length of petal stem. | Size of petal blade. |
|---|---|---|---|---|---|---|---|---|
| 128 | | | | 135 | | 25×44 | 5 | 22×34 |
| 129 | 230 | 2 | 80×90 | 60 | | 16×41 | | 32×50 |
| 130 | 330 | | 124×155 | 85 | | 18×56 | | 34×76 |
| | 300 | | 120×145 | 85 | | 19×49 | | 40×74 |
| 131 | 305 | | 98×130 | 70 | | 19×50 | | 37×62 |
| | 305 | | 78×125 | 60 | | 15×48 | | 32×44 |
| 132 | 275 | | 76×100 | 46 | | 15×39 | | 36×56 |
| | 285 | | 70×120 | 56 | | 14×46 | | 28×62 |
| 133 | 255 | | 80×115 | 56 | | 12×46 | | 22×64 |
| | 245 | | 80×110 | 60 | | 14×45 | | 38×64 |
| 134 | 115 | 44 | 60×68 | 84 | | 20×44 | 4 | 26×42 |
| | 1 | 105 | 56×70 | 90 | 28 | 34×56 | 46 | 40×46 |
| 135 | 125 | 8 | 52×66 | 24 | | 19×46 | 8 | 27×37 |
| | 115 | 20 | 46×60 | 26 | | 19×44 | 8 | 22×36 |
| 136 | 125 | 20 | 31×42 | 38 | | 15×36 | 4 | 14×34 |
| | 120 | 14 | 62×66 | 17 | 4 | 24×52 | 16 | 36×44 |
| 137 | 95 | 26 | 54×70 | 10 | | 21×53 | 12 | 32×52 |
| | 35 | 16 | 64×76 | 3 | | 16×38 | | 34×42 |
| 138 | 155 | 34 | 44×75 | 80 | | 20×45 | | 24×46 |
| | 110 | 50 | 36×60 | 33 | | 22×46 | 4 | 26×42 |
| 139 | 110 | 14 | 32×50 | 52 | | 14×35 | | 19×40 |
| | 145 | 8 | 42×60 | 48 | | 12×38 | | 17×44 |
| 140 | 95 | 60 | 60×70 | 102 | 4 | 30×52 | 12 | 33×45 |
| | 60 | 75 | 45×60 | 115 | 4 | 26×48 | 16 | 28×42 |
| 141 | 75 | 110 | 35×66 | 147 | | 23×46 | 26 | 21×44 |
| | | | spurs | 170 | 10 | 23×54 | 38 | 29×40 |
| 142 | 80 | 40 | 33×54 | 88 | | 20×44 | 5 | 20×44 |
| | 115 | 35 | 40×70 | 75 | | 20×48 | 5 | 28×45 |
| 143 | 150 | 12 | 46×84 | 55 | | 16×44 | | 14×50 |
| | 50 | 70 | 37×74 | 110 | | 17×46 | | 15×44 |
| 144 | 155 | 12 | 40×66 | 56 | | 9×34 | | 12×40 |
| | 25 | 95 | 30×53 | 140 | | 14×34 | 4 | 15×34 |
| 145 | 85 | 40 | 37×60 | 85 | | 16×38 | 4 | 26×40 |
| | 4 | | spurs | 144 | | 17×34 | 6 | 23×34 |
| 146 | 20 | | spurs | 115 | | 22×46 | 6 | 26×40 |
| | 120 | 12 | 50×68 | | | | | |
| 147 | 12 | 120 | 33×48 | 164 | | 22×43 | 6 | 24×40 |
| | 4 | 142 | 42×54 | | | | | |
| 148 | | | spurs | 85 | 12 | 31×52 | 28 | 21×40 |
| | | | spurs | 70 | 25 | 31×49 | 36 | 20×38 |
| 149 | 2 | | spurs | 135 | 4 | 20×40 | 10 | 20×38 |
| | 70 | 36 | 38×52 | | | | | |
| 150 | 210 | | 92×115 | 44 | | 18×46 | | 42×61 |
| | 210 | 8 | 60×82 | 36 | | 15×44 | | 30×48 |
| 151 | 3 | | spurs | 155 | | 20×40 | | 30×40 |
| | | | | 170 | | 23×36 | | 27×38 |
| 152 | 140 | | 31×56 | | | 26×50 | | |
| | 130 | | 33×50 | | | 30×48 | | 18×32 |
| 153 | 250 | | 80×98 | 54 | | 20×46 | | 43×58 |
| | 245 | | 75×88 | 43 | | 18×46 | | 40×56 |
| 154 | 135 | 42 | 62×76 | 95 | | 25×48 | | 33×50 |
| | 7 | | spurs | 165 | | 42×64 | 8 | 42×50 |
| 155 | 130 | 57 | 62×76 | 120 | | 22×52 | | 30×48 |
| | 122 | 14 | 47×50 | 42 | | 20×44 | | 18×33 |
| 156 | 155 | 5 | 50×62 | 26 | | 17×36 | | 32×44 |
| | 120 | 25 | 43×60 | 32 | 2 | 18×38 | 12 | 30×35 |
| 157 | 170 | 44 | 54×84 | 90 | | 22×50 | | 32×54 |
| | 110 | 70 | 39×70 | 107 | | 28×58 | 12 | 39×52 |
| 158 | 205 | 16 | 70×95 | 71 | | 20×54 | | 37×66 |
| | 115 | | 22×40 | | | | | |
| 159 | 180 | 4 | 60×66 | 32 | | 15×34 | | 32×46 |
| | 170 | 4 | 50×56 | 36 | | 12×30 | | 22×38 |

| Color of petal. | Length of filament. | Color of filament. | Length of anther. | Color of anther. | Length of ovary. | Color of ovary. | Length of style. | Color of style. | |
|---|---|---|---|---|---|---|---|---|---|
| gr., b. wh. dis | 12 | lt. gr. | 8 | lt. gr. | | note | | | note. |
| white | 6 | lt. gr. | 9 | white | 5 | white | 7 | white | note. |
| white | 9 | white | 12 | white | 12 | white | 12 | white | note. |
| white | 8 | white | 12 | white | 10 | white | 10 | white | |
| white | 9 | white | 12 | white | 8 | white | 10 | white | |
| white | 8 | white | 12 | white | 8 | white | 8 | white | |
| white | 8 | white | 12 | white | 8 | white | 10 | white | |
| white | 8 | white | 10 | white | 7 | white | 9 | white | |
| white | 8 | white | 10 | lt. gr. | 6 | white | 10 | white | |
| white | 8 | white | 10 | lt. gr. | 6 | white | 10 | white | |
| gr., ed. wh | 10 | white | 8 | lt. gr. | 6 | lt. gr. | 6 | lt. gr. | |
| gr., ed. wh. dis | 20 | lt. gr. | 12 | lt. gr. | 20 | lt. gr. | 14 | lt. gr. | |
| green | 2 | green | | | 8 | green | 14 | green | |
| green | 2 | green | | | 8 | green | 12 | green | |
| gr., ed. wh. dis | 2 | lt. gr. | | | | | | | |
| gr., ed. wh. dis. | 2 | lt. gr. | | | 10 | green | 14 | green | |
| gr., b. wh. dis | 2 | lt. gr. | | | 2 | lt. gr. | 8 | lt. gr. | |
| gr., m. wh. dis | | | | | 4 | lt. gr, | 6 | lt. gr. | |
| gr. c. 12×32 | 8 | white | 7 | lt. gr. | 5 | lt. gr. | 9 | lt. gr. | |
| gr., b. wh. dis | 8 | white | 6 | lt. gr. | 5 | lt. gr. | 10 | lt. gr. | |
| gr. c. 3×18 | 7 | white | 8 | white | 4 | lt. gr. | 6 | white | |
| white | 7 | white | 8 | lt. gr. | 4 | lt. gr. | 6 | white | |
| gr., b. wh. dis | 9 | lt. gr. | 10 | lt. gr. | 12 | green | 12 | lt. gr. | |
| gr., m. wh. dis | 12 | lt. gr. | 9 | lt. gr. | 12 | green | 16 | lt. gr. | |
| gr., b. wh. dis | 11 | lt. gr. | 9 | green | 7 | green | 7 | green | note. |
| gr., ed. wh. dis | 23 | lt. gr. | 10 | green | 18 | green | 12 | green | |
| gr. c. 12×44 | 9 | lt. gr. | 9 | lt. gr. | 6 | green | 14 | lt. gr. | |
| gr. c. 16×44 | 8 | lt. gr. | 8 | lt. gr. | 6 | green | 16 | lt. gr. | |
| gr. c. 2×50 | 7 | lt. gr. | 7 | white | 3 | green | 3 | lt. gr. | |
| gr. 2×42 | 6 | lt. gr. | 6 | white | 4 | green | 2 | lt. gr. | note. |
| white | 6 | white | 6 | lt. gr. | 3 | white | 3 | white | note. |
| gr. c. 2×12 | 7 | lt. gr. | 8 | lt. gr. | 4 | lt. gr. | 6 | white | |
| gr. c. 12×36 | 8 | lt. gr. | 8 | white | 6 | lt. gr. | 8 | lt. gr. | |
| gr., b. wh | 8 | lt. gr. | 8 | white | 6 | green | 8 | lt. gr. | |
| gr., m. wh | 10 | lt. gr. | 10 | lt. gr. | 8 | green | 10 | green | note. |
| | | | | | | | | | |
| gr., ed. wh. dis | 8 | white | 8 | lt. gr. | 4-4 | green | 8 | lt. gr. | note. |
| | | | | | | | | | |
| green | 4 | lt. gr. | 6 | lt. gr. | | | | | note. |
| green | 5 | green | 5 | green | | | | | |
| green | 6 | green | 7 | green | 6 | green | 6 | green | note. |
| | | | | | | | | | |
| gr., b. wh | 10 | lt. gr. | 12 | green | 8 | lt. gr. | 20 | lt. gr. | |
| gr., b. wh. | 9 | lt. gr. | 9 | green | 8 | lt. gr. | 12 | lt. gr. | |
| gr. c. 12×34 | 8 | lt. gr. | 7 | green | 8 | green | 8 | green | note. |
| gr. c. 12×32 | 7 | lt. gr. | 5 | green | 8 | green | 2 | white | |
| note. | 6 | lt. red | 6 | green | | | | | note. |
| red and green | 4 | red | 6 | red | | | | | |
| gr. c. 28×40 | 12 | lt. gr. | 13 | lt. gr. | 6 | lt. gr. | 18 | lt. gr. | |
| gr. c. 25×45 | 10 | lt. gr. | 13 | lt. gr. | 8 | lt. gr. | 16 | lt. gr. | |
| gr. c. 20×45 | 16 | lt. gr. | 10 | green | 8 | green | 14 | green | |
| gr. c. 30×42 | 11 | green | 11 | green | 4 | green | 12 | green | |
| gr. c. 16×35 | 9 | green | 12 | green | 8 | green | 17 | green | |
| gr., ed. wh | 4 | green | 10 | lt. gr. | 6 | green | 14 | green | |
| gr., ed. wh | 8 | green | 11 | green | 6 | green | 14 | green | |
| gr., ed. wh | 14 | green | 10 | green | 10 | green | 12 | green | |
| gr. c. 12×42 | 10 | white | 10 | green | 8 | green | 14 | lt. gr. | |
| gr. c. 20×49 | 11 | lt. gr. | 11 | green | 8 | green | 17 | lt. gr. | |
| gr. c. dis. 5×28 | 10 | lt. gr. | 10 | green | 6 | green | 20 | white | |
| | | | | | | | | | |
| gr. c. 2×12 | 8 | lt. gr. | 8 | green | 6 | green | 8 | lt. gr. | |
| gr. c. 12×26 | 7 | lt. gr. | 6 | green | 3 | lt. gr. | 5 | lt. gr. | |

| Number. | Length of stem. | Length of petiole. | Size of leaf blade. | Length of peduncle. | Length of sepal stem. | Size of sepal blade. | Length of petal stem. | Size of petal blade. |
|---|---|---|---|---|---|---|---|---|
| 160 | 115 | 46 | 36×56 | 78 | ... .... | 19×43 | 4 | 21×41 |
| | 75 | 60 | 34×50 | 80 | ..... | 18×40 | 8 | 14×34 |
| 161 | 160 | 12 | 41×65 | 50 | ..... | 14×35 | ..... | 20×38 |
| | 115 | 30 | 32×53 | 60 | ..... | 16×36 | 4 | 21×33 |
| 162 | 190 | ..... | 70×80 | 32 | .... .. | 22×48 | 2 | 38×44 |
| | 50 | ..... | 74×76 | 4 | ... .... | 12×28 | ..... | ..... |
| 163 | 90 | 80 | 60×75 | 96 | 2 | 24×48 | 8 | 40×40 |
| | 8 | 160 | 55×65 | 180 | 10 | 30×46 | 30 | 43×40 |
| 164 | 55 | 38 | 38×44 | 36 | 8 | 21×36 | 20 | 20×32 |
| | 42 | 58 | 42×48 | ..... | ..... | ..... | ..... | ..... |
| 165 | 90 | 40 | 32×50 | 66 | ... ... | 16×34 | 4 | 15×34 |
| | 54 | 50 | 32×48 | 61 | 4 | 15×32 | 10 | 16×30 |
| 166 | 1 | 100 | 33×47 | 138 | ..... | 15×34 | 8 | 20×32 |
| | ..... | 100 | 40×50 | ..... | ..... | ..... | ..... | ..... |
| 167 | 125 | 42 | 38×60 | 66 | ..... | 14×32 | 2 | 8×26 |
| | 115 | 38 | 46×54 | ..... | ..... | ..... | ..... | ..... |
| 168 | 80 | 28 | 31×54 | 67 | ..... | 16×40 | .... ... | 22×46 |
| | 1 | ..... | spurs | 145 | ..... | 22×44 | 4 | 23×40 |
| 169 | 110 | 25 | 30×50 | 52 | .... .. | 12×34 | 4 | 16×34 |
| | 80 | 40 | 30×48 | 39 | 5 | 16×34 | 14 | 16×30 |
| 170 | 44 | 96 | 42×55 | 113 | 6 | 19×38 | 20 | 23×34 |
| | 40 | 80 | 38×58 | 108 | 8 | 19×36 | 20 | 20×30 |
| 171 | 120 | 58 | 58×70 | 103 | ... .... | 22×48 | 5 | 32×48 |
| | 45 | 110 | 50×68 | 143 | 4 | 24×42 | 14 | 32×40 |
| 172 | 40 | 105 | 50×74 | 133 | 2 | 25×50 | 10 | 30×38 |
| | 2 | ..... | spurs | 220 | ..... | 25×50 | 4 | 35×48 |
| 173 | 155 | 10 | 70×65 | 20 | ..... | 25×52 | 10 | 42×46 |
| | 105 | 15 | 74×64 | 2 | ..... | 22×38 | 14 | 34×40 |
| 174 | 160 | 20 | 54×60 | 40 | ..... | 20×46 | 16 | 27×38 |
| | 145 | 20 | 60×66 | 42 | 2 | 20×50 | 12 | 32×42 |
| 175 | 70 | 40 | note | 64 | .... ... | 16×39 | 4 | 20×30 |
| | 10 | 90 | 38×52 | ..... | ..... | ..... | ..... | .... ..... |
| 176 | 2 | ..... | spurs | 200 | 2 | 26×56 | 10 | 36×44 |
| | 2 | ..... | spurs | 156 | 8 | 31×50 | 20 | 30×43 |
| 177 | 1 | 100 | 34×50 | 145 | ... .... | 20×40 | 4 | 19×40 |
| | ..... | 93 | 33×40 | 116 | 4 | 19×37 | 15 | 18×34 |
| 178 | 10 | 115 | 65×65 | 74 | 25 | 30×60 | 42 | 40×46 |
| | ..... .. | 90 | 40×55 | 72 | 12 | 28×46 | 26 | 35×40 |
| 179 | 160 | 42 | 48×72 | 64 | ..... | 19×50 | 6 | 29×44 |
| | 160 | 38 | 42×70 | 54 | ... ... | 19×45 | 8 | 22×38 |
| 180 | ..... | 105 | 40×65 | 130 | 8 | 25×48 | 22 | 26×42 |
| | ..... | ..... | spurs | 188 | ..... .. | 25×50 | 4 | 31×48 |
| 181 | 225 | ..... | 85×112 | 74 | ..... | 23×58 | ..... ... | 38×76 |
| | 233 | ..... .. | 70×100 | 48 | ..... | 15×52 | ..... | 30×62 |
| | 235 | .... ... | 86×120 | 70 | ..... | 22×58 | ..... | 44×80 |
| 182 | 330 | ..... | 103×107 | 46 | ..... | 26×54 | ..... | 44×60 |
| | 335 | 6 | 88×94 | 36 | .. .... | 26×52 | ..... | 38×52 |
| | 332 | ..... | 103×105 | 55 | ..... | 27×56 | .... .. | 40×64 |
| 183 | ..... | 85 | 36×46 | ..... | ..... | ..... | .... .. | ... . ..... |
| | 40 | 70 | 54×74 | 115 | ..... | 13×40 | ..... | 20×46 |
| | 1 | ..... .. | spurs | 142 | ..... .. | 17×40 | ..... | 30×50 |
| 184 | 66 | 44 | 36×42 | 70 | ..... | 15×35 | 8 | 17×30 |
| | 70 | 44 | 34×46 | ..... | ..... | ..... | ..... .. | ..... |
| | 60 | 44 | 32×44 | ..... | ..... | ..... | ..... | .... ..... |
| 185 | 325 | ..... | 98×127 | 95 | .... ... | 23×52 | ..... | 36×56 |
| | 320 | ..... | 100×130 | 100 | .. ..... | 37×56 | ... .. . | 35×60 |
| | 325 | ..... | 93×135 | 85 | ..... | 21×58 | ..... | .... ..... |

| Color of petal. | Length of filament. | Color of filament. | Length of anther. | Color of anther. | Length of ovary. | Color of ovary. | Length of style. | Color of style. | |
|---|---|---|---|---|---|---|---|---|---|
| gr., ed. wh | 11 | lt. gr. | 10 | green | 8 | green | 10 | green | |
| gr. pr., m. wh. dis | 10 | green | 10 | green | 10 | green | 8 | green | |
| gr. c. 6×34 | 8 | lt. gr. | 7 | lt. gr. | | | | | |
| gr. c. 18×30 | 10 | lt. gr. | 8 | green | 7 | green | 5 | green | |
| gr., ed. wh | 14 | lt. gr. | 11 | green | 9 | green | 15 | green | |
| | | | | | | | | | |
| gr., m. wh. dis | | | | | | | | | |
| gr., b. wh. dis | 13 | lt. gr. | 12 | green | 12 | green | 14 | green | |
| green | 10 | green | 20 | green | 15 | green | 15 | green | note. |
| | | | | | | | | | |
| gr., b. wh. dis | 6 | green | 7 | green | | | | | note. |
| gr., ed. wh. dis | 10 | green | 8 | green | 8 | green | 6 | green | |
| gr. pr., wh. dis | 8 | lt. gr. | 6 | lt. gr. | 2 | white | 4 | white | note. |
| | | | | | | | | | |
| gr. pr., wh. dis | | | | | | | | | |
| | | | | | | | | | |
| gr. c. 10×40 | 8 | white | 10 | lt. gr. | 5 | green | 10 | lt. gr. | |
| gr. c. 12×34 | 8 | white | 10 | lt. gr. | 4 | green | 12 | lt. gr. | |
| gr., ed. wh | 7 | lt. gr. | 5 | green | 6 | green | 4 | lt. gr. | |
| gr., m. wh. dis | 10 | green | 6 | green | | | | | |
| gr., b. wh. dis | 12 | lt. gr. | 11 | lt. gr. | 10 | green | 8 | lt. gr. | |
| gr., b. wh. dis | 14 | green | 10 | green | 10 | green | 10 | lt. gr. | |
| gr. c. 22×42 | 10 | lt. gr. | 9 | green | 6 | green | 12 | green | |
| gr. c. 30×40 | 10 | lt. gr. | 10 | green | 7 | green | 13 | green | |
| gr., ed. wh. dis. | 2 | lt. gr. | | | 14 | green | 11 | green | |
| gr., b. wh. dis | 12 | lt. gr. | 10 | green | 8 | green | 18 | green | |
| gr., ed. wh. dis | 2 | lt. gr. | | | 10 | green | 14 | green | |
| gr., ed. wh. dis | | | | | 5 | lt. gr. | 5 | lt. gr. | |
| gr., b. wh. dis | 8 | lt. gr. | 14 | lt. gr. | 5-5 | green | 12 | green | |
| gr., b. wh. dis | 12 | lt. gr. | 12 | green | 10 | green | 12 | green | |
| gr., ed. wh. dis | 5 | green | 6 | green | 3-6 | green | 9 | green | note. |
| | | | | | | | | | |
| gr., ed. wh. dis | 8 | lt. gr. | 10 | green | 14 | green | 12 | green | |
| gr., b. wh. dis | 10 | lt. gr. | 10 | green | 4-10 | green | 18 | green | note. |
| gr., b. wh. dis | 8 | lt. gr. | 6 | green | 8 | green | 5 | green | |
| gr., ed. wh. dis | 8 | lt. gr. | 7 | green | 5-5 | green | 10 | green | note. |
| gr., b. wh. dis | | note | | | 18-12 | green | 18 | green | |
| gr., ed. wh. dis | 2 | green | | | 14 | green | 12 | green | note. |
| gr., b. wh. dis | 10 | lt. gr. | 8 | green | 5-4 | green | 12 | green | |
| gr., b. wh. dis | 10 | lt. gr. | 7 | green | 4-4 | green | 13 | green | |
| gr., ed. wh. dis | 10 | green | 9 | green | 8-6 | green | 14 | green | |
| gr., b. wh. dis | 11 | lt. gr. | 11 | green | 5-7 | green | 16 | green | |
| white | 8 | lt. gr. | 14 | white | 10 | white | 9 | white | |
| white | 8 | lt. gr. | 12 | white | 8 | white | 8 | white | |
| white | 10 | lt. gr. | 14 | white | 10 | white | 10 | white | |
| gr. c. 34×50 | 11 | white | 13 | lt. gr. | 10 | lt. gr. | 18 | lt. gr. | |
| gr. c. 30×48 | 10 | white | 10 | lt. gr. | 10 | lt. gr. | 18 | white | |
| gr. c. 36×50 | 10 | white | 14 | lt. gr. | 10 | lt. gr. | 18 | white | |
| | | | | | | | | | |
| gr. c. 2×16 | 7 | white | 8 | lt. gr. | 4 | lt. gr. | 6 | lt. gr. | |
| gr. c. 4×35 | 8 | white | 8 | lt. gr. | 5 | green | 10 | lt. gr. | |
| gr., ed. wh. dis | 8 | lt. gr. | 6 | green | 1 | green | 5 | green | |
| | | | | | | | | | note. |
| | | | | | | | | | |
| white | 8 | lt. gr. | 14 | lt. gr. | 10 | white | 8 | white | note. |
| note | 8 | lt. gr. | 14 | lt. gr. | 12 | white | 8 | white | note. |
| note | 8 | lt. gr. | 14 | lt. gr. | 12 | white | 8 | white | note. |

## PLATE VIII.

Fig. 17. A photograph showing trilliums growing in the woods.

PLATE VIII.

FIG. 17.

PLATE IX.

Fig. 18. 13. A typical plant of *Trillium grandiflorum* with narrow-petaled flower.

12. A typical plant with broad-petaled flower and broad leaves, which usually accompany such flowers.

30. A plant varying from the typical ones by having short-petioled leaves, broadened sepals, petals marked with green and the "cup" formed by the bases of the petals more open than normally. One petal is entirely white, one has a slight trace of green along the centre distally and the third has a green centre stripe 3 mm. wide.

Fig. 19. 15. A plant with petioled leaves and normal flower parts, the "cup" formed by the bases of the petals showing in side view.

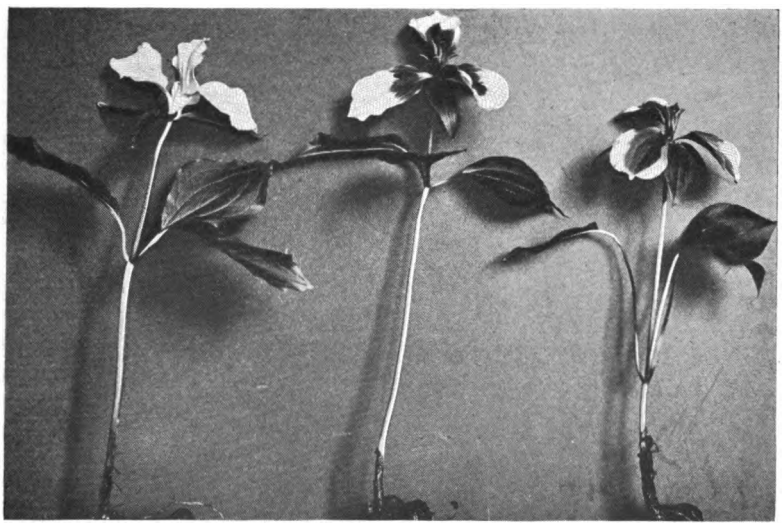
23. A plant with short-petioled leaves and with the proximal or basal portions of the petals narrowed into stems. The petals are green proximally, one of them to a lesser extent than the other two.

22. A plant with long-petioled leaves and stemmed petals.

PLATE IX.

13 12 30

FIG. 18.



15 23 22

FIG. 19.

## PLATE X.

Fig. 20. 110. A plant with petioled leaves, short-stemmed sepals, long-stemmed petals, ovary raised on a stalk and stamens with elongated filaments. Petals white-margined distally.

27. A dwarf plant with short-petioled leaves and short peduncle which brings the flowers close to the leaves. Petals short-stemmed and narrowly white-edged distally.

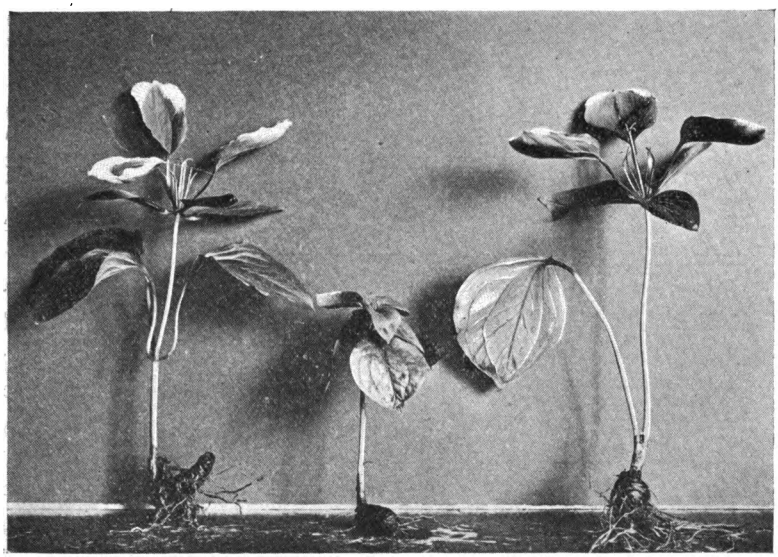
111. A stemless plant with one long-petioled broad-bladed leaf arising from the rootstock, the other two leaves being reduced to short spurs or points. The sepals are short-stemmed and broad-bladed; the petals long-stemmed, broad-bladed and white-bordered distally, the ovary is stalked and the styles are much elongated.

Fig. 21. 21. A plant in which the petioles, peduncle and petal stems are all short and all the parts are green.

109. A short-stemmed plant with long-petioled leaves, long-stemmed sepals and petals and stalked ovary with elongated styles. All parts of the plant are green.

20. A long-stemmed plant with petioled leaves, short-stemmed sepals and long-stemmed petals, which are white-edged distally.

PLATE X.



110 27 111

FIG. 20.

21 109 20

FIG. 21.

## PLATE XI.

Fig. 22. 32. A plant in which the leaves are reduced to spurs 3 mm. long, the plant stem being 60 mm. long. The broad sepals are sessile and the petals are stemmed. Two petals are distally broadly margined with white, while the third is merely white-bordered distally.

28. A plant with stem 18 mm. long and one long-petioled leaf, the other two being reduced to spurs 2 mm. long. The sepals are sessile and the petals have stems 3 mm. long and are broadly margined with white distally.

29. A plant with stem only 2 mm. long, the leaves being reduced to small spurs close to the rootstock. The sepals are sessile and the petals moderately long-stemmed.

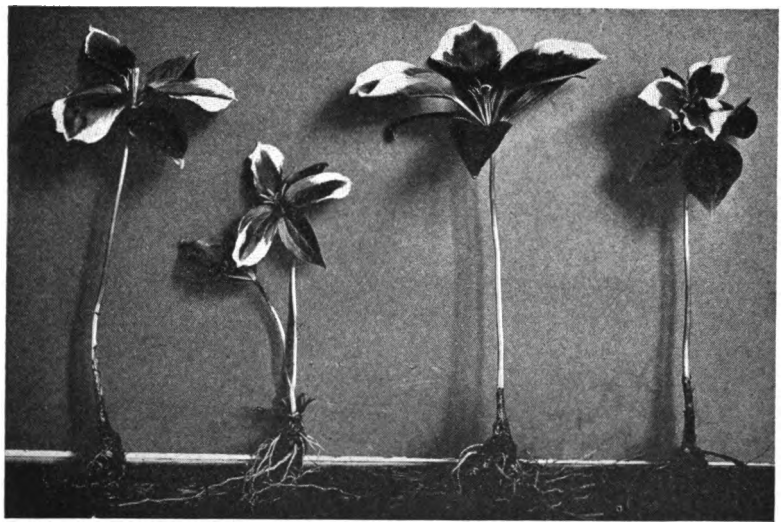
19. A plant with leaves nearly sessile and with sessile sepals and petals.

Fig. 23. 148. A plant with two flower scapes, in each of which the leaves are reduced to spurs at the tip of the rootstock. In each scape the sepals and petals are stemmed and the pistil aborted. The petals are all green.

31. A stemless plant, the leaves being reduced to spurs at the tip of the rootstock. The sepals are sessile, the petals are stemmed and white-margined and the styles are elongated.

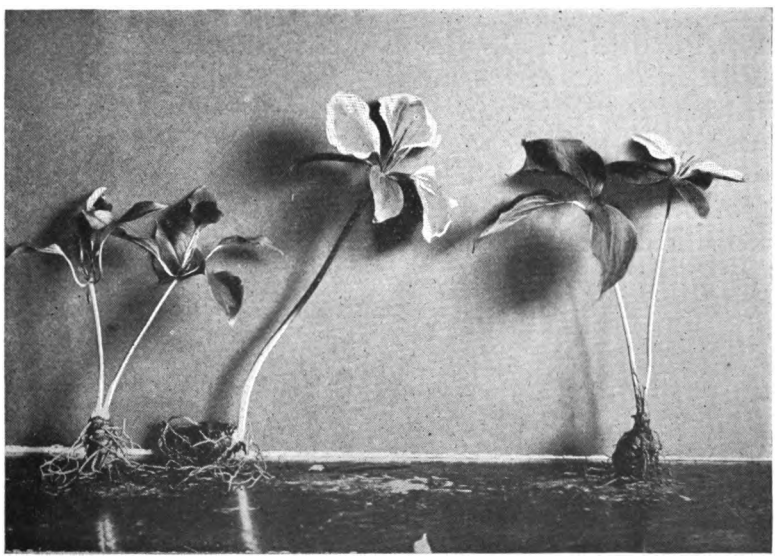
146. A two-stemmed plant in which one stem is long and surmounted by petioled leaves but has no other parts. The other stem is short and has its leaves reduced to spurs 3 mm. long. The sepals are sessile and the petals short-stemmed and white-margined.

PLATE XI.



32 28 29 19

FIG. 22.



148 31 146

FIG. 23.

## PLATE XII.

Fig. 24. 26. A plant with long-petioled leaves and with stemmed sepals and petals, one of the latter of which is shorter-stemmed and smaller-bladed than the other two. Two stamens are aborted and the rest vary in the length of their filaments and anthers.

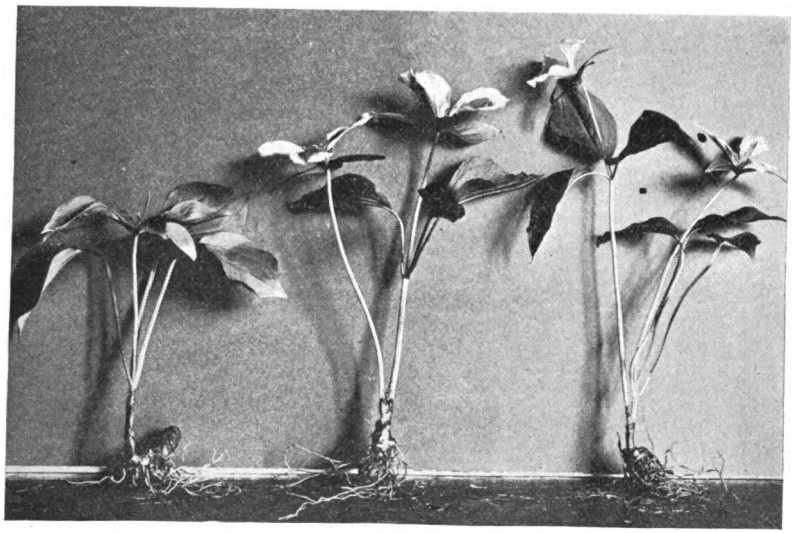
145. A plant with two flowers scapes, one of which has the leaves reduced to spurs at the tip of the rootstock while the other has well developed petioled leaves placed 40 mm. above the rootstock. In both flowers the sepals are sessile and the petals short-stemmed.

144. A two-stemmed plant in which one stem is long and bears short-petioled leaves and a flower having both sepals and petals sessile and the petals entirely white. The other stem is short and bears long-petioled leaves and a flower with sessile sepals and short-stemmed petals, one of which has a green centre stripe while the other two are green proximally and white distally.

Fig. 25. 142. A two-stemmed plant, each stem bearing petioled leaves and green-marked flowers, each with sessile sepals and short-stemmed petals.

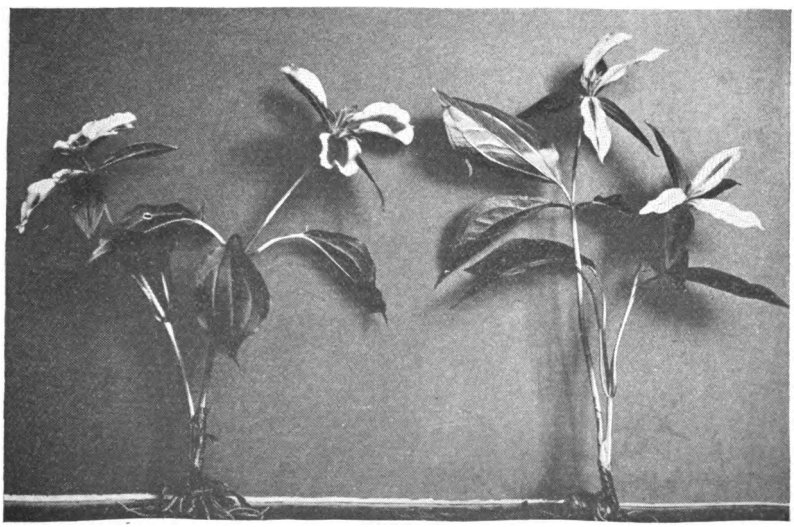
143. A two-stemmed plant, one stem of which is short and bears long-petioled leaves and a flower with sessile sepals and petals, one of which is entirely white, while the other two have green centre stripes. The other stem is long and bears shorter-petioled leaves and a flower with sessile sepals and petals, each petal being marked with a green centre stripe.

PLATE XII.



26 145 144

FIG. 24.



142 143

FIG. 25.

14

PLATE XIII.

Fig. 26. 24. A large-flowered plant with broad sessile leaves and sessile sepals and petals.

25. A large-flowered plant with short-petioled leaves and sessile sepals and petals.

18. A large-flowered plant with longer-petioled leaves, stemmed petals and somewhat elongated stamens and pistil.

PLATE XIII.

25 24 18

FIG. 26.

SUMMARY OF VARIATIONS.

When in full bloom the petals vary in color from typical white or pink, through white with green centre stripe to solid green. Those petals which are entirely green usually persist on the plant regardless of the presence or absence of leaves, and in those which are merely white-margined the green portions usually persist after the white parts have withered. Such persistent petals, the sepals and the leaves, gradually become purplish-brown in color, remaining thus colored until the plant withers to the ground. Usually by the time the carpels of the normal plants have attained their full size all traces of the abnormal plants have disappeared.

The following figures will show the limits of variation in size of the different parts of the plants which have been tabulated:

| | | |
|---|---|---|
| Length of plant stem varies from | 0 mm. | to 340 mm. |
| Length of petiole | 0 | 160 |
| Width of leaf blade | 22 | 124 |
| Length of leaf blade | 30 | 157 |
| Length of peduncle | 2 | 220 |
| Length of sepal stem | 0 | 44 |
| Width of sepal blade | 9 | 37 |
| Length of sepal blade | 26 | 78 |
| Length of petal stem | 0 | 64 |
| Width of petal blade | 8 | 50 |
| Length of petal blade | 18 | 80 |
| Length of filament | 1 | 34 |
| Length of anther | 0 | 20 |
| Length of ovary | 1 | 30 |
| Length of ovary stalk | 0 | 23 |
| Length of style | 2 | 27 |

# NOTES ON AND EXPERIMENTS WITH INSECTICIDES AND FUNGICIDES IN 1902.

CHAS. D. WOODS.

The year 1902 was not characterized by special abundance of the Colorado potato beetle. Early in the season there were only a few old beetles to be seen on most fields and compared with some years little damage was done by the potato bug even upon potatoes that were inadequately protected. The damage from the flea beetles was not any above and perhaps below that of average years. The insecticides used in the State were practically the same as in past years, Paris green taking the lead. Considerable quantities of arsenate of lead and Bug Death were used.

## PARIS GREEN.

Pure Paris green is aceto-arsenite of copper and should carry 58.65 per cent of arsenic. The arsenite of copper with 52.94 per cent of arsenic is sometimes sold under the name of Paris green. As made commercially, there is practically no Paris green which is a strictly aceto-arsenite of copper. Since arsenious oxide (white arsenic) is the cheapest single constituent that enters into the manufacture of Paris green, it follows that the manufacturer will usually endeavor to use as much white arsenic as is consistent with making a good green. Forty-five samples of Paris green have been recently examined by the Bureau of Chemistry of the U. S. Department of Agriculture. The total arsenic (arsenious oxide) ranged from 56.2 to 61.2 per cent and the copper (copper oxide) varied from 28.5 to 31.2 per cent. These analyses confirmed our own observation that there are practically no Paris greens on the market deficient in arsenic.

Since Paris green has begun to be used as an insecticide it has been a familiar experience that sometimes it burns the foliage. The reasons for this have been quite carefully investigated and it has apparently been found that this scorching of the foliage is due to the water soluble arsenic in the goods. In the Paris green

examined by the U. S. Department of Agriculture, the water soluble arsenic (arsenious oxide) varied from 2.7 to 10.5 per cent. With four exceptions there was less than six per cent of water soluble arsenic in the samples examined.

The green made by the C. T. Reynolds Company, which is very largely used in Maine, was found by the Department to carry the highest per cent of water soluble arsenic. A sample of Reynolds green examined at this Station was found to carry 7.49 per cent of arsenic soluble in water. The amount of water soluble arsenic in the Paris green is of considerable importance. In many states there are laws limiting the amount of arsenious oxide which is allowable in Paris green. In California and in Massachusetts and other eastern states, 4 per cent is the limit. In Idaho 6 per cent has been adopted as the maximum amount.

As has been pointed out in other publications of the Station, much of the harm of the soluble arsenious oxide in Paris green can be overcome by mixing it with lime water. To be most effectual, it should be mixed with the lime water several days before it is to be used and the mixture occasionally stirred, as the water soluble arsenious oxide goes into solution very slowly.

If samples of green, particularly in the original package, are sent to the Station they will receive as prompt analysis, free of charge, as is consistent with our other work. The time involved in an analysis is considerable and it is not always possible to take up the work immediately on receipt of sample.

### ARSENATE OF LEAD.

Arsenate of lead is made by the Merrimac Chemical Company and the Bowker Chemical Company, both of Boston. The Bowker Company sell their output under the name of Disparene. As sold they both carry considerable water, which seems to be necessary in order to make them go readily into suspension in water. They carry from 50 to 60 per cent of actual arsenate of lead, which gives them from 13 to 15 per cent of arsenious oxide. Hence it would take nearly four pounds of arsenate of lead as found in the market to furnish as much arsenious oxide as a pound of Paris green. The arsenate of lead is but very slightly soluble in water and on this account is safer for foliage than is Paris green. In our experiments arsenate of lead was not used with as good results in 1902 as in the two preceding seasons.

### OTHER ARSENICAL COMPOUNDS.

The arsenoids, London purple, Paragrene, etc., have been used in the State only to a very limited extent. Any one interested will find these discussed in Bulletin 68 of this Station.

### INSECTICIDES CARRYING A SMALL PERCENTAGE OF ARSENIC.

There are a number of insecticides in the market, some of which purport to be better than Paris green, all of which are dependent upon arsenic in some form for whatever value they possess as insecticide. These materials practically consist of Paris green mixed with gypsum, coal dust, or something of that kind, and are for all practical purposes simply badly adulterated Paris green. Their cost is considerably less than that of a pure green, but the poison they contain costs the consumer from five to ten times as much as it would if he were to buy a good green and mix it with the diluents.

### BLACK DEATH, QUICK DEATH, ENGLISH BUG COMPOUND.

Black Death has been quite extensively advertised in this State and probably has been more or less used. Its analysis shows it to be Paris green diluted with gypsum to make weight, and colored with charcoal or coal dust. According to the analysis of the U. S. Department of Agriculture it carries about 1.75 per cent of Paris green; the other constituents being chiefly gypsum and carbon. It follows, therefore, that it would take more than fifty pounds of Black Death to equal one pound of Paris green as an insecticide.

Quick Death, made by the American Insecticide Company, Binghamton, N. Y., in appearance and composition resembles Black Death and is stated by those who should know to be Black Death under another name.

English Bug Compound has not been heard of very much lately. A sample examined a few years ago consisted of white arsenic diluted with gypsum.

### KNO-BUG.

Kno-bug is a reddish brown powder made by the Carpenter-Morton Company of Boston, which, according to the claim of the makers in 1902, destroys potato bugs, acts as a vegetable tonic, stimulates the growth of the plant, and prevents blight, scab and rust.

The material is found to contain several things, of which Paris green is the poison, nitrate of potash the plant food, and carbonate of copper the germicide.

Analysis of the material shows it to have substantially the following composition:

| | |
|---|---|
| Calcium sulphate (land plaster), | 88.0 per cent. |
| Iron ochre, | 2.0 per cent. |
| Nitrate of potash, | 4.5 per cent. |
| Paris green, | 2.5 per cent. |
| Carbonate of copper, | 2.0 per cent. |
| Water and undetermined, | 1.0 per cent. |

The Paris green in these goods is the only thing of much value to the potato grower. The plaster and nitrate of potash contain plant food, but the benefit to be obtained from small applications above ground is inconsiderable.

The goods sell according to the advertisements at prices ranging from five to ten cents per pound, according to the size of the package. Its high cost comes chiefly from the fact that it is put up in small packages. A mixture of Paris green and plaster which will equal Kno-bug as an insecticide can be made by the farmer for very much less cost.

In a newspaper bulletin issued last June by the Station, Kno-bug was called a fraud. It was so called because it claimed to be better than Paris green and safer to use as an insecticide, when it depended upon Paris green for its value as an insecticide; because it claimed to prevent blight, for which carbonate of copper is not a specific; and because it was claimed to prevent scab, which cannot be done by any treatment of vines. The manufacturers, Carpenter-Morton Company, Boston, state that they acted in good faith and had no intention of fraud in putting the goods on the market, and that chemists in whom they had confidence advised them that its ingredients would produce the results claimed. The coming season they intend to make no claim for Kno-bug as a fungicide, and will base their reasons for its sale upon its merits as an insecticide.

A field test of Kno-bug was made by the Station in 1902 chiefly to ascertain if it had value as a fungicide. The first application was made when the potatoes were about a foot high. This piece had been previously sprayed with Bordeaux mixture and arsenate of lead. No further application of Bordeaux mixture was made

to this plot. The adjoining plots were sprayed four more times with Bordeaux mixture and a poison. The yield was much less on the plot to which Kno-Bug was applied and the percentage of rot was very much increased. The vines died three weeks earlier than on the plots treated with Bordeaux mixture.

In this test Kno-bug was practically valueless as a fungicide. The diminished yield was due to blight and not to injury from insects. Applied in sufficient quantity, the Paris green contained in Kno-bug will kill the bugs.

### HAMMOND'S SLUG SHOT.

Hammond slug shot carries sulphur, carbolic acid, Paris green, and tobacco, mixed with gypsum. The manufacturers claim it to carry only one per cent of arsenic. A sample examined by the U. S. Department of Agriculture carried 1.58 per cent of arsenic in the form of Paris green.

## INSECTICIDES NOT CONTAINING ARSENIC.

### BUG DEATH.

Bug Death, made by the Danforth Chemical Company, Leominster, Mass., is unique in being, so far as has come to the writer's attention, the only insecticide which does not depend upon arsenic for its effectiveness. It is practically impure zinc oxide. It carries more or less of iron and lead oxide and small amounts of silica, chlorine, potash and phosphoric acid. These latter constituents are apparently accidental and vary somewhat within narrow limits. When the goods were first placed upon the market, their mechanical condition was very different from what it is at present. In 1900 the Experiment Station used it in the field at Houlton and also in a green house test. The Bug Death killed some of the beetles and slugs and drove the majority of the others from the plants. Many of them went into a stupor lasting from 12 to 36 hours and then revived and were apparently as well as ever. The goods used that year were coarsely ground, feeling gritty to the touch and could not have been sprayed successfully, as they would have clogged a Vermorel nozzle. The Bug Death used by the Station in the season of 1902 was ground to an impalpable powder and even at the rate of 40 pounds to the barrel was sprayed through a Vermorel

nozzle without any difficulty. One enthusiastic user of Bug Death in Maine believes it to be exceedingly valuable as a means of ridding cucumber and squash vines of the striped bug. It will be thoroughly tested by the Station the coming season on the melon family, and if it should prove efficient it will be very valuable, because thus far we have no adequate remedy for the striped beetle.

In 1900 Bug Death was used by us in the dry form; in 1902 it was used by us in connection with Bordeaux mixture and applied by spraying. The full account of this experiment is given on pages and, as will be there noted, at the rate of 62½ to 125 pounds per acre, in five applications, it was efficient as an insecticide. The following is the summary of the results of experiments in 1900 as given in Bulletin 68 of this Station.

1. As an insecticide, at the rate of 100 pounds per acre, it freed from bugs; at the rate of 40 pounds per acre it had no appreciable effect.

2. As a fungicide; blight did not appear so soon or so badly when Bug Death was applied, in three applications, at the rate of 180 pounds per acre, as on untreated vines.

3. Effect on foliage; at the rate of 40 pounds per acre, no appreciable effect; at the rate of 100 pounds per acre, some of the leaves curled on the edges and finally died.

4. Fertilizer; as its only fertilizer constituent is a little potash with a trace of phosphoric acid, it was not tested as a source of plant food.

5. Its economy; because of its high cost and slow application, no one growing any considerable amount of potatoes can afford to use Bug Death.

The results of the experiments described on page seem to warrant a modification of conclusions 1 and 5 so that they will read as follows:

1. As an insecticide. Applied in a fine spray at the rate of 15 pounds per acre at each application, it will free the potato vines from bugs well enough for practical purposes; and at the rate of 25 pounds, it is thoroughly efficient as a remedy against the potato bug.

5. Applied with Bordeaux mixture, it can be as cheaply and as easily applied as Paris green or arsenate of lead. The experiments by Mr. Rogers and the Danforth Chemical Company

seem to indicate a sufficiently increased yield to pay its cost ($5 to $7). These results are *not* confirmed by the Station experiments.

NOTES ON FUNGICIDES.

The year 1902 is the first year in which potato blight has been particularly bad since the Station began experiments in the great potato growing section of this State. In 1901 there was a large acreage with some blight and rot on unsprayed fields. In that season sprayed potatoes, even though treated only once or twice were free from blight and rot. Unfortunately this apparent help from imperfect protection led many to believe that the four to six sprayings urged by the Station were unnecessary and that two sprayings were equally good. In 1902, even in the case in which the spraying has been quite thorough, the results have been disappointing, as the protection has been only partial. For example: In the Experiment Station experiments with insecticides there was found on fairly drained ground a loss of 10 per cent due to rot, and on poorly drained ground the loss was much greater. One large grower recently at the Station was much discouraged at the outlook; he said he sprayed three times and fully half of his potatoes rotted. However, it came out in the course of the conversation that a piece which he sprayed twice rotted so badly that he did not dig them. Thus the extra spraying gave him one-half of a crop and it is probable that if he had sprayed twice more his loss from rot would have been no greater than in the Station experiments. The blight progressed peculiarly the present season. For the most part potatoes were late planted and through July and August made very rapid growth, much of the time an inch a day. This soft, succulent foliage was apparently peculiarly susceptible to the blight. Blight, however, did not appear until late, so that in most instances the tops were covering the ground and forming a dense mat at the time in which it appeared and most pieces had not been sprayed for some little time previous for fear of injuring the tops by driving through the field. The blight progressed somewhat slowly but still made decided progress at lower temperatures than has usually been supposed to be favorable to its growth. While pieces quite thoroughly treated have not been perfectly free from rot, the season has added to the importance

of thorough spraying as a protection against blight and the subsequent rot. The fact that pieces planted on land not well drained and on farm manure suffered worse from rot than where the conditions were different, points out the necessity for careful selection of potato land. The ill effects of farm manure seem to indicate that the fungus which produces the rot may be distributed through the soil as well as through the tops. This is in accord with observations made before Bordeaux mixture was used and confirms the soundness of the usual practice of planting on turf land with commercial fertilizers.

Ready made Bordeaux mixtures were not used in experiments in the Station this year. In former years they gave fairly satisfactory results. Some users in 1902 are not as well satisfied as though they had used the regular home made mixture. This can probably be explained by the fact that if they had used the ready made goods in accordance with directions which come with them, they were only about one-half the strength of the home made goods.

## EXPERIMENTS WITH PARIS GREEN, BUG DEATH AND ARSENATE OF LEAD.

In the season of 1901 some users of Bug Death were satisfied that they got a larger yield of potatoes where Bug Death was used as an insecticide in conjunction with Bordeaux mixture than where Paris green was used also with Bordeaux mixture. Many articles were written for the agricultural press condemning the use of Paris green on the ground that it injured the foliage, thus stopping growth, and one writer made the claim that the tubers themselves contained arsenic when Paris green was used for killing bugs. Therefore, an experiment was undertaken to compare arsenical poisons with Bug Death, with the view of ascertaining whether arsenic in the form of Paris green or arsenate of lead injures the growth of the potato vines so as to affect the quantity or the quality of the tubers.

Field experiments at best are apt to be unsatisfactory because of lack of uniformity of soil and stand of the crop. In order to avoid the former the experiment was arranged alternately in ribbon strips, so the number of plots might reduce the inequalities of soil as far as possible. The chief difficulty of the experiments in 1902 was missing hills. The field which at planting

was intended for this experiment was not used because of the number of missing hills. A field was finally selected on which the stand was fairly uniform. The land had been uniformly manured the preceding year and had grown potatoes and the yield of 1901 was fairly uniform over the whole field, being somewhat smaller on the north side; the yield gradually increasing to the south. Eight rows running across the field, so as to include nearly one half acre, was selected for each plot. At harvest the two outer rows of each plot were rejected and 14 rods of the west end of 6 rows were used for the comparative yields. The potatoes from these pieces were assorted and weighed in the field. All of the details of the experiment were under the personal supervision of the director or Mr. Bartlett, chemist to the Station. Twice at the time of taking notes representatives of the Danforth Chemical Company and of the Merrimac Chemical Company were present and their judgment agreed with the notes taken.

The amounts of Bug Death used per acre were those suggested by Mr. Merrill, the superintendent of the Danforth Chemical Company. The field was sprayed five times, July 12, July 19, July 26, August 2, and August 27. Bordeaux mixture was used at each application at the rate of a barrel to the acre. The Paris green and arsenate of lead were used only in the four first applications. Bug Death, at the request of Mr. Merrill, was used in all five applications. The arrangement of plots and yields are given in the table on page . The rows ran east and west, plot one being on the north side.

FIELD NOTES.

Plots were all sprayed July 12.

July 15 there were very few eggs on the pieces and no slugs had hatched. The plants had formed two or three leaves since they were sprayed the 12th.

July 19 plots all sprayed.

July 22 slugs just beginning to hatch and practically no slugs of any size on the entire field. The notes for the individual plots were practically all alike. Occasional plants over the piece had a few newly hatched slugs on the terminal leaves.

July 26, all plots sprayed.

July 27. Plot 1. Few small slugs on occasional plants. Plot 2. Quite free from bugs, but rather more than on plot 1. Practically no large slugs. Plot 3. Rather more slugs than on plot 2, particularly on the south

side of the plot. Plot 4. Some slugs, rather less than on plot 1 and small. Plot 5. About the same as plot 4. Very few slugs. Plot 6. Had no slugs; all smaller than on plot 5; vines somewhat eaten. Plot 7. Very few slugs, less than on 1 or 4. Plots 8-9. Few small slugs, about same as plot 2. Plot 10. Practically no slugs, cleaner than any of the preceding plots. Plots 11-12. About the same as plot 5, rather less slugs, if anything.

August 2 all sprayed.

August 5. Plot 1. Very few slugs, a few old bugs, tops not eaten. Plot 2. No small slugs, a few large ones, tops eaten more than on 1. Plot 3. About the same as plot 2, perhaps not eaten so much nor quite so many slugs. Plot 4. Practically no bugs or slugs, tops very little eaten. Plot 5. Practically as plot 4 as regards bugs, the tops appeared larger than the preceding plots. Plot 6. About the same as 3, not as free from bugs and slugs as 4 and 5, eaten rather more than 4 or 5, tops fully as large as on plot 5. Plot 7. About as plot 4 but not so much eaten. Plot 8. Slugs and bugs as on plot 2, perhaps tops not quite so much eaten. Plot 9. Rather better than 6, less bugs and less eaten than on plot 6. Plot 10. Cleanest from bugs and less signs of their work than on any of the plots 1 to 9. Plot 11. Very clean, but not quite so free from bugs as 10 and more traces of their work than on plot 10. Plot 12. Not quite so free from bugs as plot 11 and more eaten. Plots 1 to 12, for all practical purposes, are very free from bugs, a few leaves on occasional plants had been eaten to a small extent. No plants on the whole piece damaged enough to have any probable effect on yield.

August 27 some blight on all of the plots, leaves yellowed on some plots. Occasional spots on some green leaves. No perceptible difference between the plots of each different kind of insecticide that was used. The general appearance of the crop is too light color to the tops. It is more marked on some rows and especially on the plots near the north side of the field. Some rows are much more affected than others. There is no bloom to be seen on the entire field at a distance. An occasional plant is in the last stage of flowering. The Bug Death was used on plots 2, 5, 8, 11, but no insecticides on the other plots.

September 2, blight on unsprayed fields has made much progress in the past week. Vines with stalks and leaves green a week ago have only the stems left. On Mr. Watson's fields, which had not been sprayed for four weeks, the disease had progressed considerably. The experimental plots are about the same as a week ago, still green with some blight. No noticeable difference between different plots.

September 11. Blight has made a good deal of progress. A few plants died on all the plots; many plants still as green as ever and most of the plants are quite green. No perceptible difference between the different plots. The plots were harvested October 8, 9 and 10. The tops were all dead, having been killed by frost about the middle of September.

PARIS GREEN, BUG DEATH AND ARSENATE OF LEAD COMPARED.

*Kind and amount of insecticide, the weighed yield of potatoes, and the starch content of the merchantable potatoes. Bordeaux mixture was used five times on each plot.*

| Plot number. | Insecticides Used, Kind. | Amount per acre. | Yield of Potatoes Per Acre. | | | | Starch. |
|---|---|---|---|---|---|---|---|
| | | | Merchantable. | Small. | Rotten.* | Total. | |
| | | lbs. | bush | bush | bush | bush | per ct. |
| 1 | Paris green | 21 | 295 | 36 | 32 | 363 | 21.28 |
| 2 | Bug Death | 60 | 315 | 34 | 23 | 372 | 21.28 |
| 3 | Arsenate of Lead | 4 | 285 | 27 | 25 | 337 | 21.41 |
| 4 | Paris green | 12 | 305 | 28 | 40 | 373 | 21.41 |
| 5 | Bug Death | 125 | 290 | 34 | 35 | 359 | 22.06 |
| 6 | Arsenate of lead | 24 | 295 | 29 | 80† | 404 | 18 84 |
| 7 | Paris green | 4 | 285 | 25 | 58† | 368 | 19 50 |
| 8 | Bug Death | 75 | 320 | 23 | 55† | 398 | 18.46 |
| 9 | Arsenate of lead | 8 | 320 | 27 | 50† | 397 | 19.19 |
| 10 | Paris green | 8 | 370 | 34 | 28 | 432 | 19.46 |
| 11 | Bug Death | 100 | 350 | 25 | 35 | 410 | 18.25 |
| 12 | Arsenate of lead | 16 | 365 | 26 | 41 | 432 | 18 87 |
| | Average Paris green | | 314 | 31 | 42 | 384 | 20.41 |
| | Average Bug Death | | 319 | 29 | 37 | 385 | 20.01 |
| | Average Arsenate of lead | | 318 | 27 | 49 | 393 | 19.58 |

*There was no soft rot. This includes all discolored potatoes.

† Depression on part of the field with more rot where the soil was wetter.

SUMMARY OF RESULTS OF THIS EXPERIMENT.

At no time during growth were there perceptible difference in color, size or vigor of the vines treated with different insecticides. All these insecticides kept their respective plots sufficiently free from insects to prevent damage; the smaller amounts of the insecticides were nearly as effective as the larger. The poisons were applied early so that the vines were protected before the bugs appeared. Paris green kept the vines a little freer than Bug Death, and Bug Death acted quicker than arsenate of lead, but all three were effective from the practical standpoint.

The yield was smaller on the northern side and increased gradually towards the southern side. The yields were fairly uniform on adjoining plots and the average of the results showed practically no differences in the yield from the plots treated with different insecticides. The loss due to rot was

something less than 10 per cent of the total yield on most plots. Because of depressions on plots 6-9, the soil was not as well drained and the rot was increased to about 15 per cent.

The potatoes all had a high starch content, with but little differences. There was no apparent relation between the starch content and the kind of insecticide used. In general the plots having the largest yield had the largest potatoes and the lowest starch content.

The potatoes from plots which were treated with Paris green at the rate of 8 and 12 pounds per acre and arsenate of lead at the rate of 16 and 24 pounds were tested for arsenic and were found to be entirely free.

## EXPERIMENTS BY MR. ROGERS OF BRUNSWICK.

Two experiments comparing Paris green, Bug Death and arsenate of lead were made in 1902 by Mr. E. A. Rogers of Brunswick. One of these experiments was conducted at Brunswick and the other was made for the Danforth Chemical Company in Caribou. Mr. Rogers furnished the Station the full report of these experiments, but as they have been printed in detail in the Maine Farmer only a summary is here given of the experiments and Mr. Rogers' conclusions.

TABLE SHOWING PLAN AND YIELD PER ACRE IN EXPERIMENT AT BRUNSWICK.

| Plots. | Insecticides Used, Kind. | Lbs. per acre. | Yield per Acre in Bushels. | | | |
|---|---|---|---|---|---|---|
| | | | Marketable—large. | Rotten. | Small. | Total. |
| 2 | Bug Death | 125 | 415 | 11 | 16 | 442 |
| 3 | Arsenate of lead | 15 | 358½ | 4 | 18½ | 381 |
| 4 | Paris green | 7½ | 354 | 8 | 22½ | 384½ |
| 5 | Bug Death | 125 | 369 | 5 | 15½ | 389½ |
| 6 | Arsenate of lead | 15 | 328 | 7 | 20½ | 355½ |
| 7 | Paris green | 7½ | 330½ | ½ | 18½ | 349½ |
| 8 | Bug Death | 125 | 362 | ½ | 20½ | 382½ |
| 9 | Arsenate of lead | 15 | 320 | 1½ | 23½ | 344½ |
| 10 | Paris green | 7½ | 279 | 1½ | 18½ | 299 |
| | Average marketable. | Bush. | | | | |
| | Bug Death | 382 | | | | |
| | Arsenate of lead | 335½ | | | | |
| | Paris green | 321½ | | | | |

TABLE SHOWING PLAN AND YIELD PER ACRE IN EXPERIMENT AT CARIBOU.

| Plot number. | Insecticides Used, Kind. | Pounds. | Yield per acre in bushels. | | Total. |
|---|---|---|---|---|---|
| | | | Marketable. | Small and rotten. | |
| 1 | Bug Death | 100 | 279 | 66 | 345 |
| 2 | Paris green | 4 | 247 | 74 | 321 |
| 3 | Bug Death | 100 | 282 | 77 | 359 |
| 4 | Arsenate of lead | 8 | 245 | 78 | 323 |
| 5 | Bug death | 100 | 303 | 53 | 356 |
| | | Bush. | | | |
| | Total average yield per acre for Bug Death | 353½ | | | |
| | Total av. (Plot 2) yield per acre for Paris green | 321 | | | |
| | Total av. (Plot 4) yield per acre for arsenate of lead | 323 | | | |

In both of the experiments conducted by Mr. Rogers the yields were considerably larger on the Bug Death plots than on the Paris green or arsenate of lead plots. From the experiments at Brunswick and Caribou Mr. Rogers draws the conclusion that Bug Death was much the best insecticide used; that it did its work much better and cleaner than either Paris green or arsenate of lead; that Bug Death preserves the life of the vines and that the increased yield from the use of Bug Death would more than pay its cost.

In the Station experiments at Houlton, Paris green was the most efficacious of the three insecticides used, although Bug Death at the rate of 15 pounds and arsenate of lead at the rate of 2 pounds to the acre in each application were efficacious for all practical purposes. There was no difference in the appearance of the vines due to the different insecticides during the growth, nor in the yield of potatoes. One desiring to use an insecticide for plants free from arsenic will, according to our experience, find Bug Death satisfactory when applied in sufficient quantities. Bug Death can be readily applied with Bordeaux mixture up to 40 pounds to the barrel. According to our experience, 15 pounds per acre at each application is nearly as effective as a larger amount.

## OAT SMUT AND ITS PREVENTION.

CHAS. D. WOODS.

Farmers' Bulletin No. 75 of the U. S. Department of Agriculture describes the grain smuts and explains how they may be prevented. This bulletin may be obtained by addressing the Secretary of Agriculture, Washington, D. C., from your Congressman or from the Maine Experiment Station.

The following, selected from the "summary" of bulletin 75, outlines the disease, its cause and its prevention:

Smuts of cereals are caused by minute parasitic fungi, the spores or seed-like bodies of which form the black, dusty mass which takes the place of the kernels or the entire head.

The spores are very minute and are easily blown about, often adhering to the kernel before it is planted. When such kernels sprout, the spores also germinate and send delicate threads into the young seedlings. These threads follow the growth of the plant, fill the head as soon as formed, and there develop a mass of spores instead of kernels.

Loose smut of wheat attacks the whole head and converts it into a mass of loose, dusty spores. It causes considerable damage in some localities and is more difficult to prevent than other smuts.

Loose smut of oats is very similar to loose smut of wheat and probably causes an annual loss in the United States of more than $18,000,000.

Barley is attacked by two smuts and rye by one. Corn smut is widespread, but fortunately it usually causes only very slight loss. As yet no effective remedy is known for corn smut.

The formalin treatment has been found very effective in preventing stinking smuts of wheat and oat smut. It consists in soaking the seed for two hours in a solution of 1 pound of formalin to 50 to 60 gallons of water. The strong formalin is poisonous, and great care should be exercised in its use. [For a full description of how to use the formalin see page 211.]

The stinking smuts of wheat and oat smut can also be prevented by treating the seed with hot water at 132° for ten minutes.

Loose smut of wheat and barley smuts can be prevented by soaking the seed in cold water for four hours, allowing it to stand four hours more in wet sacks, and then treating for five minutes in water at 132°.

The potassium-sulphide treatment is thoroughly effective for loose smut of oats. It consists in soaking, say, 3 bushels of seed for twenty-four hours in a solution of 1½ pounds of potassium sulphide to 25 gallons of water. Liver of sulphur should be used and the solution should be kept in a tightly closed vessel to protect it from the air.

To dry the grain after any of the treatments described, spread it on a clean floor, or on canvas sheets spread in the sun, preferably on a raised lattice work, say, 2 or 3 inches deep, and turn it over at least twice a day.

In treating oats for smut by either potassium sulphide or hot water an increase in yield is obtained beyond and above the amount that would result from replacing the smutted heads with sound ones. The increase in yield from seed treatment is usually two or three times as much as the apparent loss from smut in untreated fields.

The Wisconsin Experiment Station* found oats smut very prevalent in that state and estimated the loss from this disease in 1901 to have exceeded six million dollars. They have successfully experimented with formaldehyde with the following results.

SUMMARY OF EXPERIMENTS AT WISCONSIN STATION.

| Seed oats submerged for | In a solution | Smut found. |
|---|---|---|
| Twenty minutes | 1 lb. formaldehyde to 50 gal. water | 0.0 per ct. |
| Sixty minutes | 1 lb. formaldehyde to 200 gal. water | 20.0 per ct. |
| Ten minutes | 1 lb. formaldehyde to 50 gal. water | 1.0 per ct. |
| Forty minutes | 1 lb. formaldehyde to 100 gal. water | 4.3 per ct. |
| Twenty minutes | 1 lb. formaldehyde to 100 gal. water | 5.0 per ct. |
| Not treated | | |

* Bulletin 91 Wisconsin Experiment Station.

## HOW TO TREAT SEED OATS TO PREVENT SMUT.

As the result of field experiments the Wisconsin Station recommends the following:

"If 50 bushels of seed oats are to be treated, secure from a drug store one pound or a pint of formaldehyde (sometimes called formalin.) Speak to your druggist in advance so that he may secure the formaldehyde in time, if he does not have it on hand. Put into a barrel or cask 50 gallons of water and pour in the one pound of formaldehyde liquid to make the proper solution. Dip out about one-half of the solution into another cask in order to treat two sacks of oats at the same time, thus facilitating the work. Place about two bushels of oats in each of two gunny sacks or large bags and submerge the oats in the solution for twenty minutes; then lift the sacks from the casks and let drain for a minute or two so as to save the solution. Empty the oats on a threshing floor or on a canvas to dry and proceed as before, using the same sacks for the remainder of the oats."

"The solution as used is not poisonous and will not injure the sacks or clothing coming in contact with it. Formaldehyde is a gas generated by burning wood alcohol. It is readily soluble in water, which will hold 40 per cent of it in solution. This solution is sold by most drug stores under the name of formaldehyde or formalin at about 50 cents per pound."

"It is well to treat the seed oats two or three days before sowing to give ample time to dry. If the oats are shoveled over a few times it will facilitate the drying very much and no difficulty will be experienced sowing with seeder or drill. The treated oats can be sown with a force-feed drill or seeder when quite damp, but the machine should be set so that it will indicate sowing about a peck more than the quantity desired per acre, as the oats are swollen and will not run quite as freely as dry oats."

"The treatment of seed oats seems to facilitate the sprouting; a difference of from two to four days in favor of the oats treated will be noticeable."

# NEWSPAPER BULLETINS PUBLISHED IN 1902.

CHAS. D. WOODS.

Whenever there is matter of importance which we wish to bring promptly to the attention of the people of the State, we make as clear and concise a statement as possible in the style and type of a newspaper column and mail it as a "Special Newspaper Bulletin" to all the press of the Station exchange mailing list. These newspaper bulletins are quite generally printed by the papers and the Station is under obligations to the press for this opportunity of specially and promptly being put in touch with the people.

During the year the Station has issued several special newspaper bulletins on miscellaneous subjects and 12 monthly meteorological bulletins. The results of the meteorological observations thus reported are summarized beyond. The matter of 6 of the newspaper bulletins has not appeared in any of the regular bulletins of the Station and is therefore here reprinted as a matter of permanent record.

## FRESH FISH AS MANURE.

A correspondent at Livermore Centre wrote the Maine Experiment Station asking for information as to the value of fresh fish as a fertilizer. The following reply was sent:

"Fresh fish and fish waste have been used for manure by farmers living along the coast for generations and there is no question as to their fertilizing value for all farm crops. Fish is not, however, a complete fertilizer and its chief value is due to the nitrogen it contains. In the fresh unground fish the phosphoric acid of the bones is not immediately available to plants but becomes so in time when mixed with the soil. Fish contains practically no potash and unless this ingredient is supplied either in the form of potash salts or wood ashes the land soon becomes exhausted of its available supply.

"Dried fish has an average composition of water 12 per cent, nitrogent 7.25 per cent and phosphoric acid 8.25 per cent. The

fresh fish would probably contain 50 to 60 per cent of water and proportionately less nitrogen and phosphoric acid. Unless it could be bought very cheaply it would not be an economical fertilizer in your locality, as you would have to pay freight on a large amount of water having no manurial value.

"Tankage can be obtained from the Portland Rendering Company, Portland, Me., guaranteed to carry 6 per cent nitrogen and 14 per cent phosphoric acid, for about $20 per ton. This mixed with muriate of potash, about 200 lbs. muriate to 1,800 lbs. tankage, and about 1,000 lbs. of the mixture applied to the acre would be good and economical manuring for grass or orchard land. The muriate can be obtained of Kendall & Whitney, Portland, or the Sagadahoc Fertilizer Co., Bowdoinham, Me. Ashes could be used with the tankage instead of the muriate, applying about 800 lbs. tankage and 1,500 lbs. ashes to the acre. The ashes should not be mixed with the tankage until time to apply to the land and should be worked into the soil for best results."

## THE ANGORA GOAT.

*Experience of the Maine Agricultural Experiment Station.*

The first problem we met was suitable fencing. We soon found that while they do not jump they are good climbers, and that they will go over any fence the top of which they can reach with the fore feet. The horns on some of the ewes point backward in a V shape. In the case of a woven wire fence with square openings, even with 4 inch mesh, they will push their heads through the openings and get hung by their horns. With this kind of a fence it was necessary to visit them two or three times a day to release the prisoners. The Ellwood poultry fence (not poultry netting) of the American Fence Company, with small diamond shaped openings, has proven perfectly satisfactory. It costs about a third more than the ordinary woven wire fence of equal height.

In 1901 we gave them too extensive a range and they did but little clearing up. In May, 1902, six ewes, one buck and five kids were put in an acre of young woodland of a mixed growth, most of the trees three to six inches in diameter. There was quite a thick growth of underbrush. The small underbrush of birch, maple, hazel bush, etc., have been cleaned up so that where there

are no alders or evergreens the ground under the trees is as clean as though it had been burned over. Sweet fern they do not like very well but they have cleaned all of the hardhack out of this piece. Ferns and brakes have been eaten to some extent. They have eaten the leaves and young sprigs of bushes in preference to grass. Birches two inches or more in diameter they have not injured but they have stripped the bark from every maple. Even maple trees six inches in diameter have been thus killed. We have found them to be fond of the bark of apple trees, even eating the bark from old trees.

To clean up birch or evergreen wood land they have proven very effective. There has been practically no cost for the summer's keeping. The twelve goats have been kept without other food on one acre of young wood land. They have required no care other than an occasional visit to see that they are all right and that they have water. Salt was given occasionally.

## THE MANAGEMENT OF RASPBERRIES AND BLACKBERRIES.

A correspondent asks the Maine Experiment Station for information as to the time for pruning and transplanting raspberries and blackberries. In reply the following suggestions were made.

"The ideal treatment for raspberries and blackberries is to pinch them back at intervals during the summer and thus secure strong, sturdy bushes 3½ to 4 feet high, with laterals 1 to 1½ feet long, rather than to practice severe heading back after the plants have become long and 'leggy.' If, however, as is frequently the case even in the best managed gardens, the plants are at this season making vigorous growth which may not mature, they should at once be cut back to the desired height and the canes will harden before cold weather. Many prefer to cut back the bushes in the spring, after the extent of winter-killing is determined. Thinning the canes, which should always be practiced, may be done at any time during the season. In general one-half, or more, of the young canes which appear should be cut out.

"Blackberry and raspberry bushes may be transplanted this fall if the work is done immediately, but better results are usually obtained from spring planting. Currants, on the other hand, have given rather better results from fall setting."

### APPLES AND PLUMS FOR CENTRAL MAINE.

A correspondent at Sandy Point, asked the Maine Experiment Station for information as to varieties of apples and plums to plant for market. The following reply was sent:

"The question of varieties is largely an individual matter, and depends upon soil, location, markets and personal preferences. For home use and certain local markets, as the summer resorts, it is well to have a succession of varieties lasting through the season, and the list should include the choicest dessert varieties. For the ordinary village markets and for distant shipment, however, plant a few standard varieties which have a recognized market value. Such varieties are usually highly colored, good keepers and of good quality.

"In general, for the section of the State in which you are located—Waldo and adjoining counties—the following apples would be suitable for the first purpose mentioned: Oldenburg, Williams' Favorite, Alexander, Munson Sweet, Garden Royal, Starkey (not Stark), Gravenstein, Fameuse, Northern Spy, Tallman, Baldwin.

"For shipment Gravenstein, Baldwin, and Tallman make a good trio. Ben Davis is a handsome apple and a good shipper, but the quality is poor.

"Of plums, Reine Claude (Bavay's Green Gage) stands easily at the head for market purposes and it is of excellent quality. Burbank and Arctic (Mooers' Arctic) are remarkably vigorous and productive, but of second quality. McLaughlin is one of the choicest for home use."

### EXPERIMENTS WITH CLOVER.

In co-operation with the United States department of agriculture the Maine Agricultural Experiment Station has during the past season conducted a comparative study of red clover obtained from different parts of the world. The object of this study is to determine, if possible, the best source from which to obtain seed for general farm purposes. To this end the questions considered were: rate and per cent of germination; date of blooming and consequent earliness of crop; date of cutting; yield per acre; general condition of the stand.

Some striking differences were noted, but of course no general conclusions can be drawn from one season's work. Seed was sown May 19 on 58 plots of two square rods each. The first bloom was noted August 2, on plots with the seed from England, Russia, Nebraska, Tennessee, Iowa, and Missouri. The first plots ready for harvest (cut just in bloom) were those from Indiana and one lot from Bohemia. The largest yields were obtained, in the order given, from plots with seed from Bohemia, Indiana, Minnesota, Wisconsin, Brittany, Ohio. Plants from American seed were invariably very hairy while those from European seed were almost as invariably smooth.

The experiment will be continued through another growing season and the results will be given in detail in a station bulletin.

## LOW GRADE COTTONSEED MEAL.

Within the past three weeks (December, 1902) several samples of low grade cottonseed meal have been sent to the Maine Agricultural Experiment Station for analysis. These came from widely separated parts of the State, but were all from the jobbing house of Oscar Holway and Company of Auburn. These goods were differently branded and two lots carried no guaranteed analysis. The retailers were notified of the quality of the goods and their sale stopped. This meal carried from 24 to 34 per cent protein and is the first low grade goods that has come to my attention for nearly two years. As directed by law I have reported the violations to the Commissioner of Agriculture who is following the matter up.

Dealers or consumers who have dark colored cottonseed meal or meal containing black specks should, for their protection, send a sample to the Station for analysis. The sample is best sent by mail in a tin box—an old spice box answers nicely. A description of the goods including a copy of the guaranteed analysis should be sent with the sample. The analysis will be promptly made and reported free of charge.

Residents of the State are again reminded that the Station is always ready to make free analyses of samples of all kinds of concentrated feeding stuffs sent by them. By availing themselves of this, which has been a standing offer for six years, users and handlers of feeding stuffs will have a protection from low grade goods such as can be obtained in no other way.

## METEOROLOGICAL OBSERVATIONS.

Lat. 44° 54′ 2″ N. Lon. 68° 40′ 11″ W. Elevation 150 feet.

The instruments used at this Station are the same as those used in preceding years, and include: Wet and dry bulb thermometers; maximum and minimum thermometers; thermograph; rain-gauge; self-recording anemometer, vane, and barometer. The observations at Orono now form an almost unbroken record of thirty-four years.

In this section of the State the winter of 1901-2 was more than two degrees warmer than the average, while the snowfall was only about three-fourths of the usual amount. March was remarkably warm, with almost no snow after the middle of the month. This soon disappeared and the indications pointed towards an early spring. May, however, proved cool with much cloudiness. June, also, was cloudy and the rainfall was nearly double the normal. Frequent showers, much cloudiness, and a low temperature characterized the growing season throughout the greater portion of the State. Much of the sweet corn raised for canning purposes failed to mature and in many sections grain lodged badly. From an agricultural stand-point, the season as a whole was unfavorable.

## METEOROLOGICAL SUMMARY FOR 1902.

### Observations Made at the Maine Experiment Station.

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Mean. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Highest barometer | 30.40 | 30.20 | 30.40 | 30.07 | 30.25 | 30.18 | 30.08 | 30.05 | 30.25 | 30.33 | 30.26 | 30.58 | 30.25 | ..... |
| Lowest barometer | 28.81 | 28.67 | 29.16 | 29.06 | 29.30 | 29.12 | 29.46 | 29.40 | 29.54 | 29.10 | 29.25 | 29.36 | 29.19 | ..... |
| Mean barometer | 29.81 | 29.60 | 29.54 | 29.71 | 29.79 | 29.62 | 29.80 | 29.76 | 29.92 | 29.82 | 29.84 | 29.85 | 29.75 | ..... |
| Highest temperature | 47°.0 | 52°.0 | 62°.0 | 75°.0 | 83°.0 | 84°.0 | 87°.0 | 85°.0 | 82°.0 | 75°.0 | 58°.0 | 53°.0 | ..... | ..... |
| Lowest temperature | -16°.0 | -15°.0 | -2°.0 | 27°.0 | 28°.0 | 34°.0 | 43°.0 | 39°.0 | 30°.0 | 17°.0 | 18°.0 | -20°.0 | ..... | ..... |
| Mean temperature | 17°.32 | 22°.11 | 36°.90 | 43°.40 | 50°.61 | 56°.80 | 64°.13 | 63°.07 | 59°.47 | 47°.26 | 37°.16 | 17°.13 | 42°.11 | ..... |
| Mean temperature for 34 years | 16°.05 | 19°.22 | 27°.81 | 40°.59 | 52°.28 | 61°.92 | 66°.97 | 65°.07 | 57°.23 | 46°.06 | 34°.25 | 20°.62 | 42°.34 | ..... |
| Total precipitation in inches | 3.65 | 1.80 | 8.89 | 2.94 | 2.77 | 6.03 | 1.81 | 4.96 | 1.94 | 5.04 | 1.76 | 4.77 | ..... | 46.36 |
| Mean precipitation for 34 years | 4.34 | 3.99 | 4.44 | 2.90 | 3.55 | 3.65 | 3.25 | 3.62 | 3.34 | 3.97 | 4 28 | 3.87 | ..... | 45.20 |
| No. of days with precip. of .01 in. or more | 10 | 8 | 19 | 13 | 10 | 16 | 8 | 10 | 8 | 13 | 7 | 11 | ..... | 133 |
| Snow fall in inches | 13.0 | 18.0 | 14.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 3.0 | 24.5 | ..... | 72.5 |
| Average snow fall for 34 years | 23.0 | 21.5 | 16.8 | 5.2 | ..... | ..... | ..... | ..... | ..... | ..... | 8.0 | 17.2 | ..... | 91.7 |
| Number of clear days | 12 | 16 | 10 | 13 | 11 | 9 | 9 | 5 | 12 | 8 | 9 | 13 | ..... | 127 |
| Number of fair days | 4 | 2 | 5 | 4 | 5 | 6 | 10 | 11 | 6 | 6 | 5 | 4 | ..... | 68 |
| Number of cloudy days | 15 | 10 | 16 | 13 | 15 | 15 | 12 | 15 | 12 | 17 | 16 | 14 | ..... | 170 |
| Total movement of wind in miles | 6718 | 6168 | 7655 | 5974 | 6911 | 5640 | 4093 | 4784 | 4292 | 6689 | 5042 | 5218 | ..... | ..... |

## Monthly and Annual Precipitation (as rain) for the Year 1902.

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Annual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bar Harbor | 4.05 | 3.83 | 14.37 | 3.07 | 2.52 | 7.60 | 1.75 | 3.24 | 2.50 | 5.11 | 1.79 | 7.12 | 56.95 |
| Belfast | 3.37 | 2.59 | 12.70 | 3.00 | 1.85 | 6.38 | 1.52 | 4.62 | 1.84 | 5.05 | 1.34 | 4.90 | 49.16 |
| Bemis | ... .. | 1.52 | 4.82 | ... .... | 4.15 | 4.63 | 1.02 | 3.71 | 2.62 | | | | ... .... |
| Carmel | 1.75 | 2.42 | 10.97 | 2.51 | 2.94 | 5.57 | 4.02 | 3.08 | 2.06 | 3.71 | 2.02 | 2.45 | 43.50 |
| Cornish | 4.18 | 2.61 | 8.10 | 6.56 | 3.05 | 4.92 | 3.24 | 8.26 | 6.68 | 6.80 | 1.70 | 7.06 | 63.16 |
| Eastport | 3.41 | 3.06 | 9.11 | 2.16 | 3.85 | 2.51 | 1.05 | 3.23 | 2.43 | 3.36 | 1.47 | 5.77 | 41.41 |
| Fairfield | 2.25 | 1.54 | 7.76 | 2.41 | 2.54 | 4.01 | 2.22 | 4.06 | 1.86 | 4.01 | 1.03 | 4.68 | 38.40 |
| Farmington | 3.06 | 2 32 | 8.43 | 3.67 | 5.16 | 5.28 | 1.93 | 3.34 | 3.60 | 4.68 | 1.19 | 4.31 | 46.97 |
| Fort Fairfield | .... ... | ... .... | 2.62 | 0.57 | 2.10 | 4.38 | 2.99 | 2.55 | 3.10 | 1.75 | 0.95 | ..... | ..... |
| Gardiner | 2.67 | 1.70 | 10.33 | 3.71 | 2.01 | 4.52 | 2.07 | 4.46 | 3.23 | 4 90 | 1.21 | 5.35 | 46.15 |
| Houlton | ..... | ..... | ..... | 1.25 | 2.87 | 8.06 | 3.28 | 4.09 | 4.10 | 4.73 | 1.88 | 4.62 | ... .... |
| Kineo | 2.15 | 3.60 | 4.73 | 2.65 | 4.67 | 6.15 | 4.03 | 3.01 | 5.46 | ..... | 0.81 | 2.01 | .. ..... |
| Lewiston | 3.04 | 3.01 | 8.96 | 4.37 | 2.67 | 5.21 | 2.02 | 3.52 | 3.70 | 5.07 | 1.45 | 5.26 | 48.28 |
| Mayfield | 3.21 | 3.60 | 9.50 | 4.16 | 3.40 | 7.39 | 2.95 | 6.36 | 4.33 | 5.83 | 1.65 | 4.12 | 56.50 |
| North Bridgton | 4.36 | 2.55 | 8.21 | 4.67 | 3.98 | 5.50 | 2.66 | 4.21 | 4.11 | 5.72 | 1.78 | 6.27 | 54.02 |
| Orono | 3.65 | 1.80 | 8.59 | 2.94 | 2.77 | 6.03 | 1.81 | 4.86 | 1.94 | 5.04 | 1.76 | 4.77 | 46.36 |
| Patten | ... ... | ..... | ..... | 1.00 | 3.52 | 6.20 | 3.00 | 3.80 | 4.30 | 4.80 | . .. | 2.20 | ..... |
| Portland | 2.73 | 3.34 | 8.76 | 3.97 | 2.17 | 3.78 | 2.21 | 4.36 | 4.08 | 4.95 | 0.86 | 6.54 | 47.75 |
| Rumford Falls | 1.76 | 2.19 | 3.12 | 3.31 | 5.32 | 4.45 | 2.31 | 3.86 | 3.88 | 4.14 | 1.47 | 4 60 | 40.41 |
| Van Buren | ... .... | .... | ... ... | 2.17 | 4.42 | 6.54 | 3.48 | 2.69 | 5.64 | 5.51 | 2.24 | 2.75 | ..... |
| Vanceboro | ..... | ... .. | ..... | ... .... | ..... | 4.05 | 2.26 | 2.54 | 2.60 | 5.97 | 0.90 | 2.70 | .... ... |

With the exception of readings from the Orono station, the above table is compiled from the monthly bulletins of the U. S. Weather Bureau.

# REPORT OF THE TREASURER.

Maine Agricultural Experiment Station in account with the United States appropriation, 1901-1902.

DR.

| | | |
|---|---|---|
| To receipts from the Treasurer of the United States as per appropriation for the fiscal year ending June 30, 1902, as per act of Congress approved March 2, 1887 | | $15,000 00 |

CR.

| | | |
|---|---|---|
| By salaries: | | |
| (a) Director and administration officers | $2,418 12 | |
| (b) Scientific staff | 3,507 66 | |
| (c) Assistants to scientific staff | 1,893 43 | |
| (d) Special and temporary services | 63 31 | |
| Total | | 7,882 52 |
| Labor: | | |
| (a) Monthly employees | $450 00 | |
| (b) Daily employees | 1,331 20 | |
| (c) Hourly employees | 6 95 | |
| Total | | 1,788 15 |
| Publications | | 245 00 |
| Postage and stationery | | 243 65 |
| Freight and express | | 229 75 |
| Heat, light and water | | 953 09 |
| Chemical supplies: | | |
| (a) Chemicals | $279 68 | |
| (b) Other supplies | 50 52 | |
| Total | | 330 20 |
| Seeds, plants and sundry supplies: | | |
| (a) Agricultural | $70 60 | |
| (b) Horticultural | 213 76 | |
| (c) Miscellaneous | 125 13 | |
| Total | | 409 49 |

| | | |
|---|---|---|
| Fertilizers | | $157 17 |
| Feeding stuffs | | 1,000 33 |
| Library | | 218 09 |
| Tools, implements and machinery | | 116 63 |
| Furniture and fixtures | | 113 26 |
| Scientific apparatus | | 103 64 |
| Live stock: | | |
| (a) Horses | $50 00 | |
| (e) Poultry | 118 35 | |
| (f) Sundries | 80 15 | |
| Total | | 248 50 |
| Contingent expenses | | 15 00 |
| Traveling expenses | | 259 62 |
| Buildings and repairs | | 685 91 |
| Total | | $15,000 00 |

ISAIAH K. STETSON, *Treasurer.*

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I, the undersigned, duly appointed Auditor of the Corporation, do hereby certify that I have examined the books of the Maine Agricultural Experiment Station for the fiscal year ending June 30, 1902, that I have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00, and the corresponding disbursements, $15,000.00; for all of which proper vouchers are on file and have been examined by me and found correct.

And I further certify that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887.

GEO. E. FELLOWS, *Auditor.*

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Maine Agricultural Experiment Station in account with "General Account" for the year ending June 30, 1902.

Dr.

| | | |
|---|---|---|
| To balance from 1901-1902 | $493 05 | |
| Sales of produce, etc | 3,115 06 | $3,608 11 |

Cr.

| | | |
|---|---|---|
| By salaries | $1,000 00 | |
| Labor | 980 42 | |
| Feeding stuffs | 500 00 | |
| Postage and stationery | 100 00 | |
| Buildings and repairs | 254 20 | |
| Balance to 1902-3 account | 773 49 | 3,608 11 |

# INDEX TO EXPERIMENT STATION REPORT.